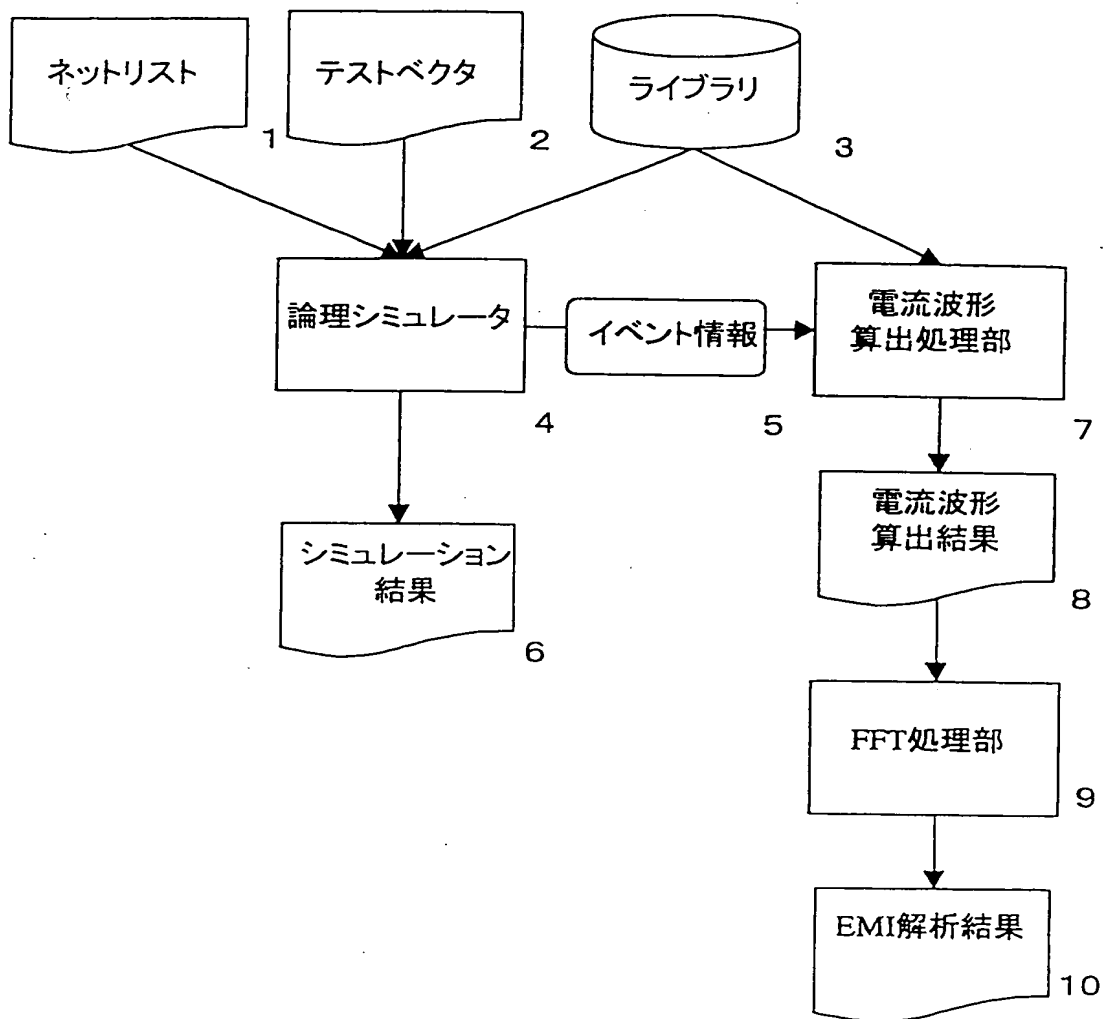


【書類名】

図面

Fig. 1

図1 全体ブロック図



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Fig. 2

図2電流波形算出処理  
 ブロック図(実施形態1)

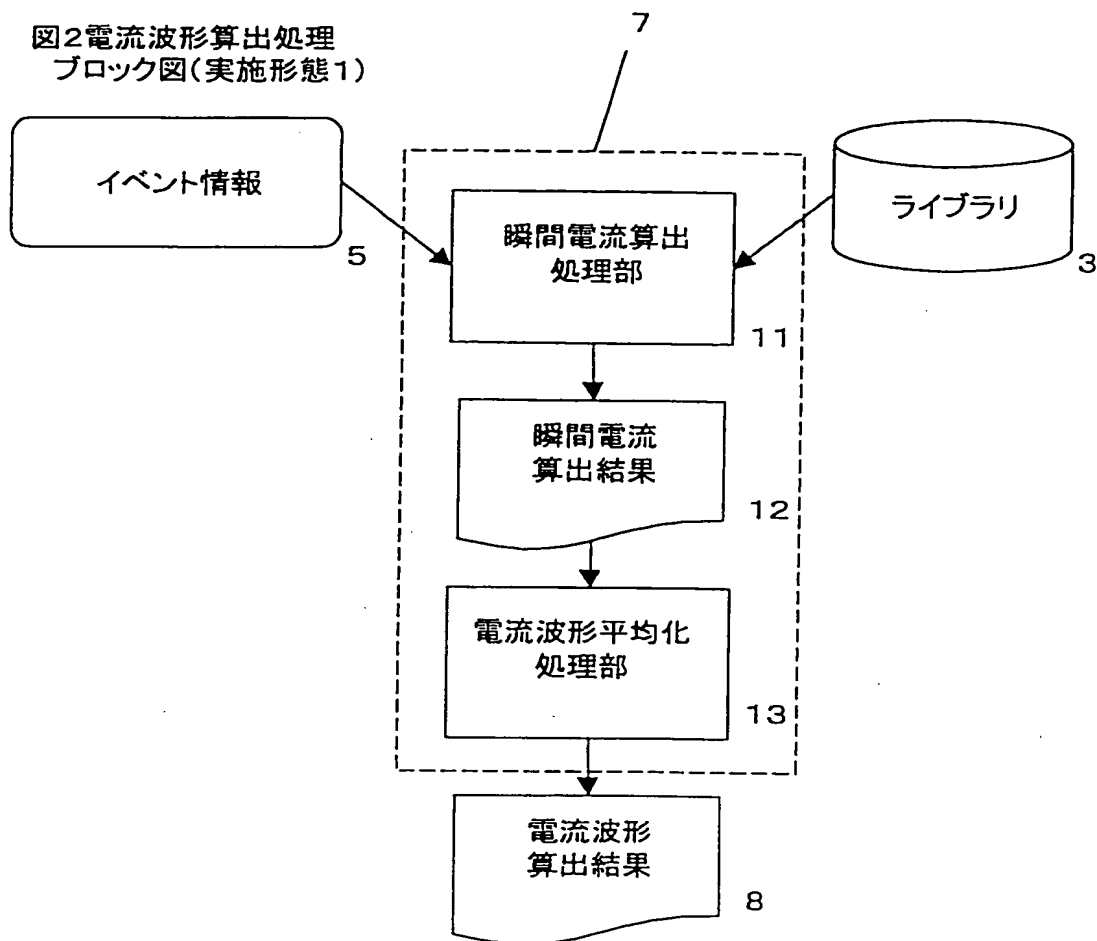


Fig. 3

図3 瞬間電流算出結果

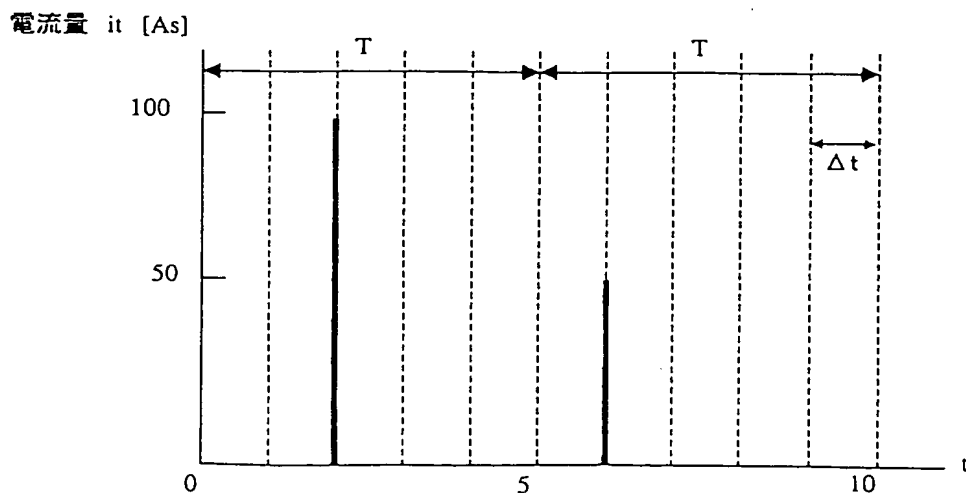


図4 電流波形平均化処理フロー図

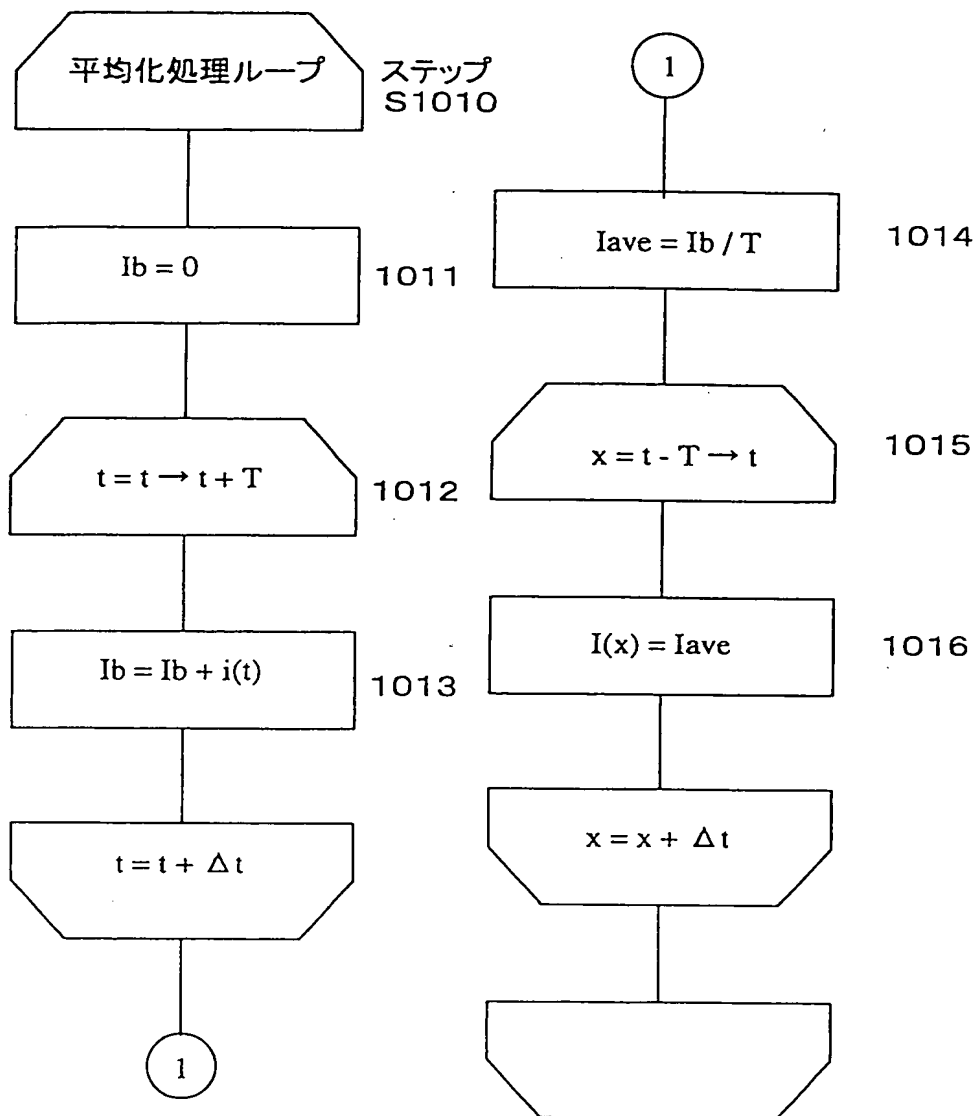
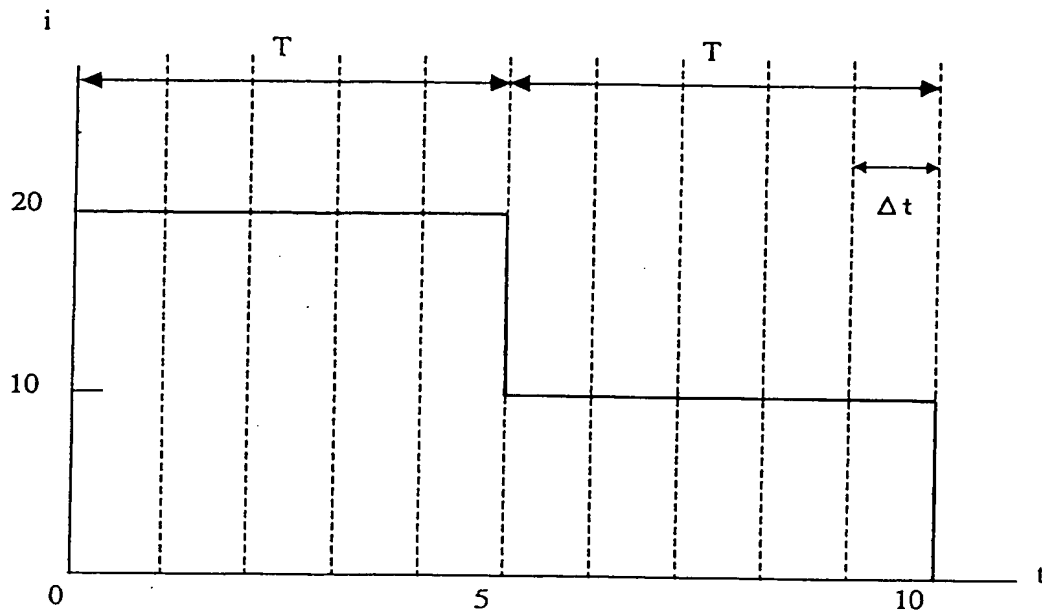


Fig. 5

図5 電流波形算出結果(実施形態1)



$T=5$  の時

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Fig. 6

図6 FFT解析結果

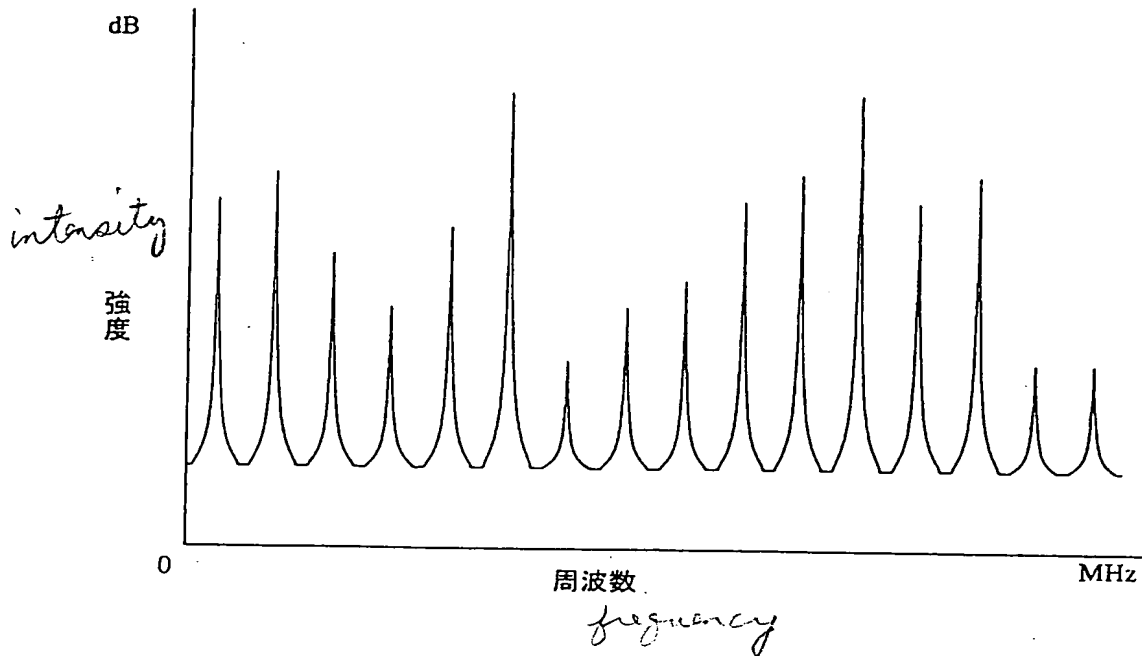


Fig. 7

図7 矩形波モデル(実施形態2)

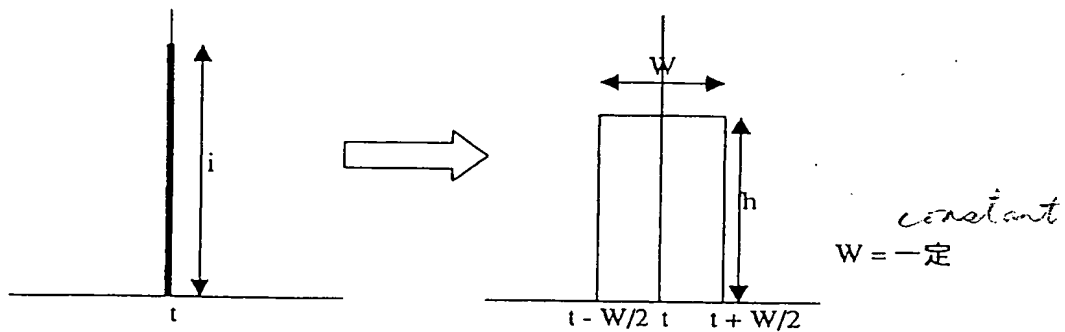
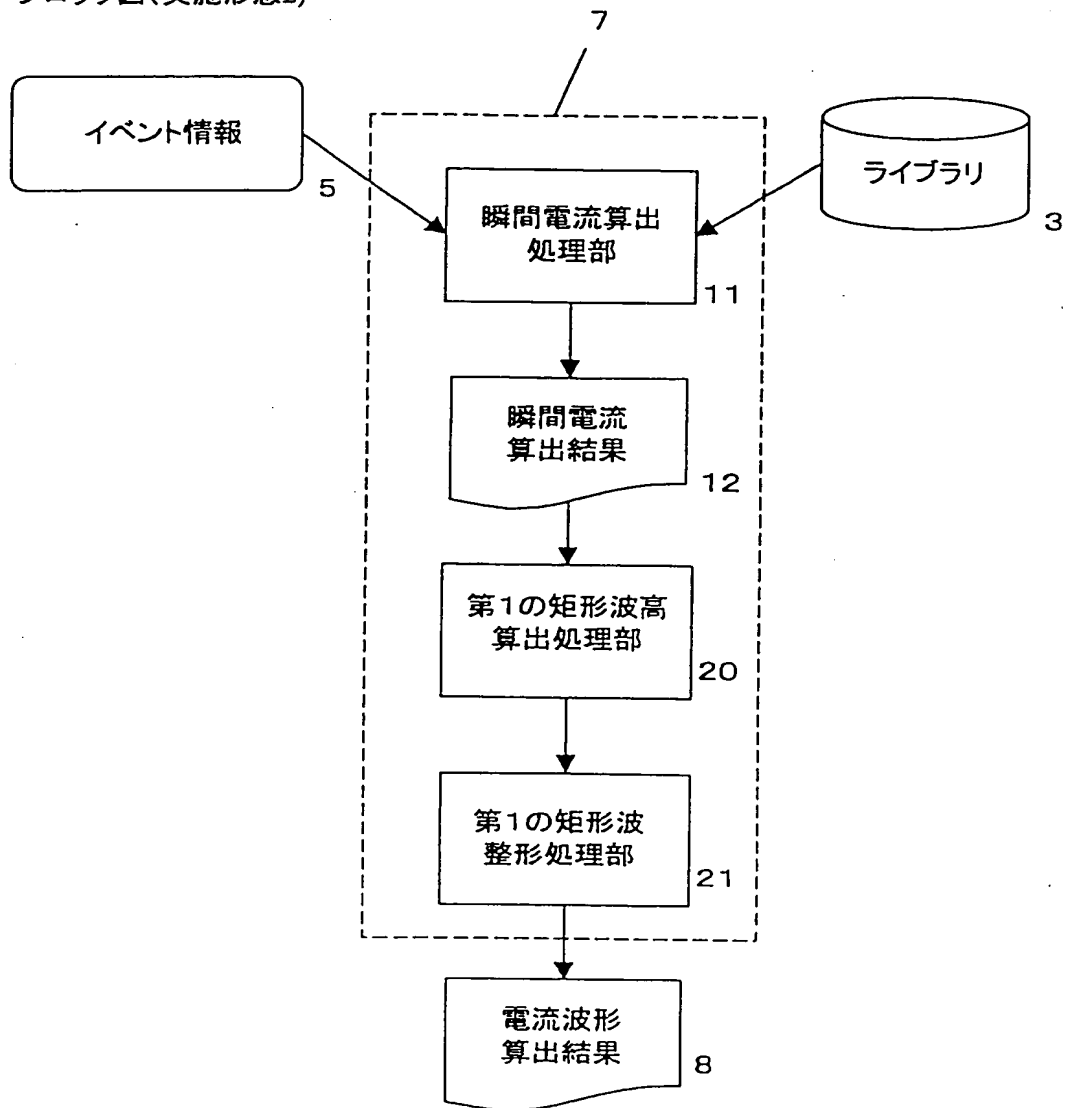


Fig. 8

図8電流波形算出処理  
 ブロック図(実施形態2)

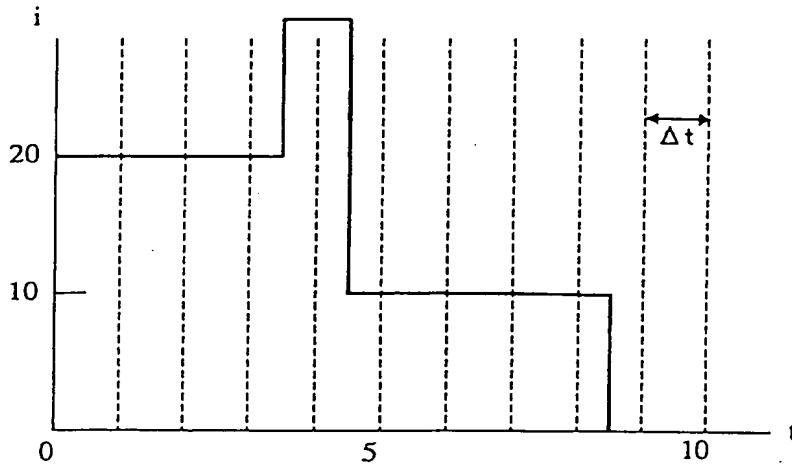


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Fig. 10

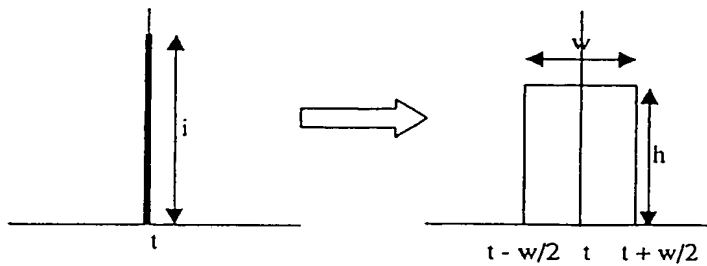
図10 電流波形算出結果(実施形態2)



**W = 5 の時**

Fig. 11

図11 矩形波モデル(実施形態3)



$$i = W \times h = \frac{h^2}{K}$$

$$h = \sqrt{(i \times K)}$$

$$h/w = K = \text{一定}$$



00000000000000000000000000000000

図12 電流波形算出処理  
ブロック図(実施形態3)

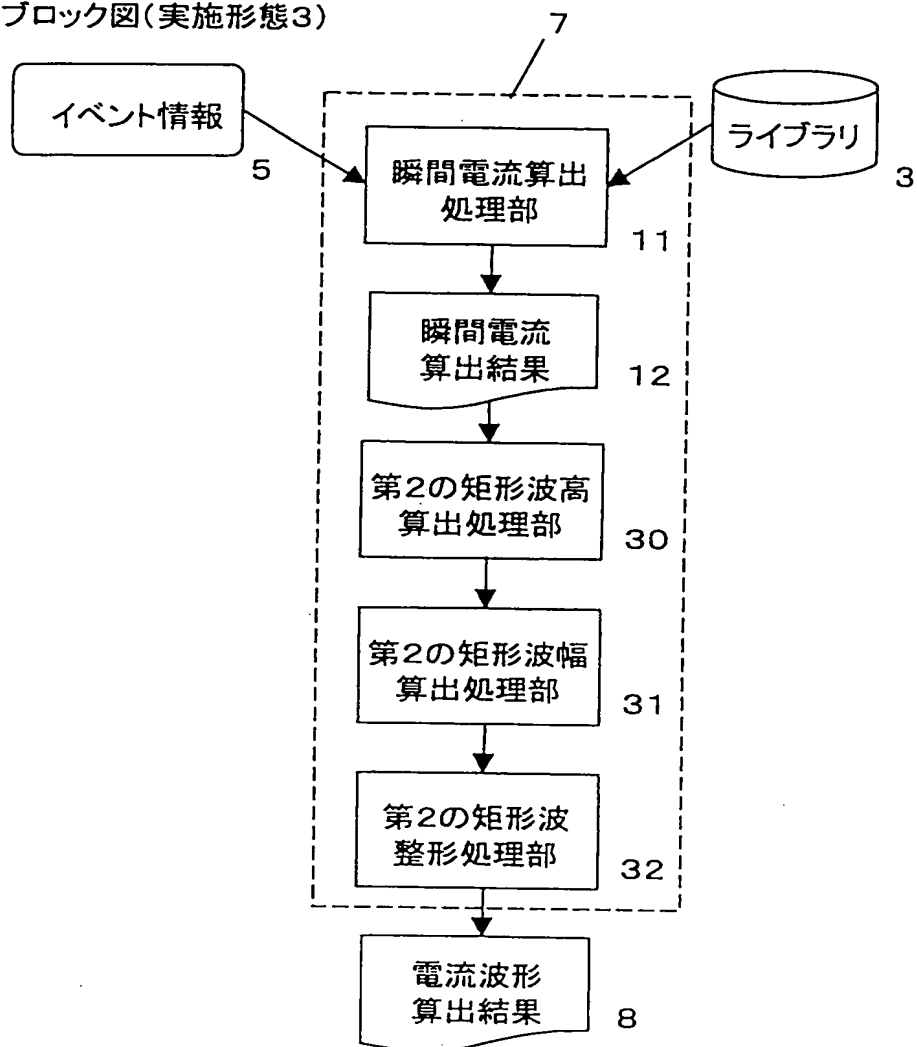
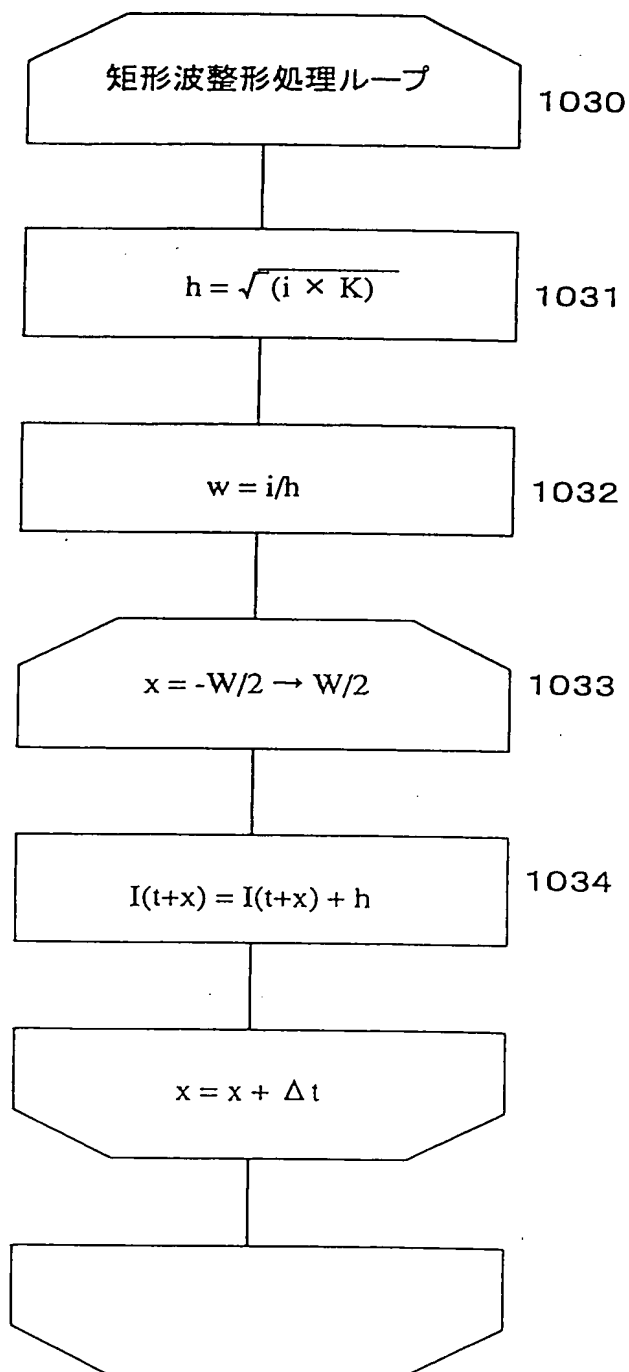


Fig. 13

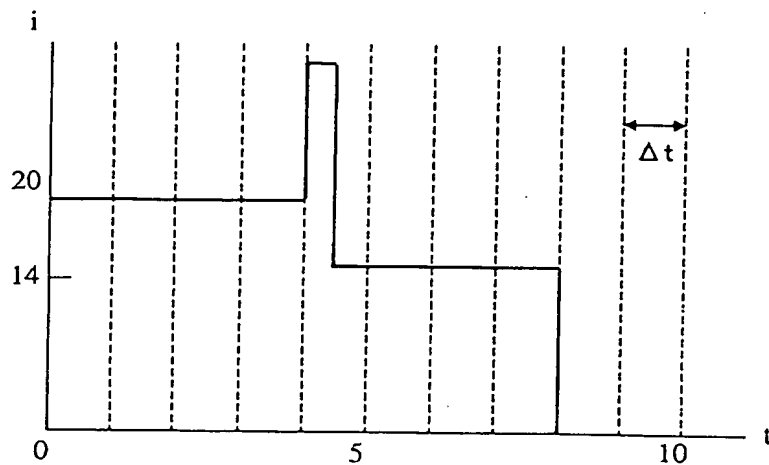
図13 第2の矩形波整形処理フロー図



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Fig. 14

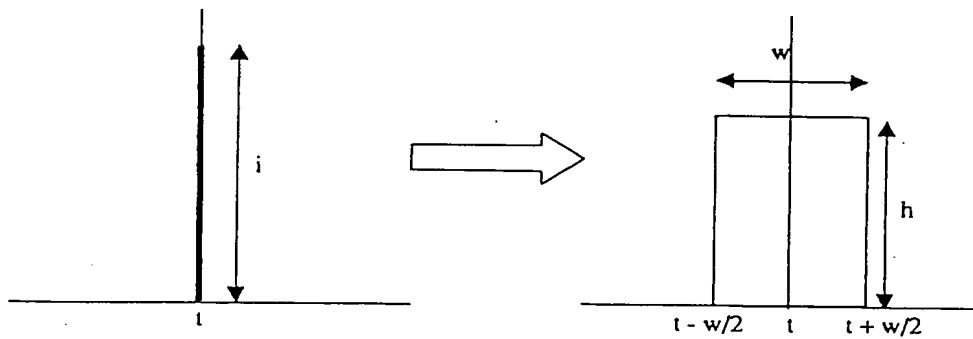
図14 電流波形算出結果(実施形態3)



K=4の時

Fig. 15

図15 矩形波モデル(実施形態4,5,6)

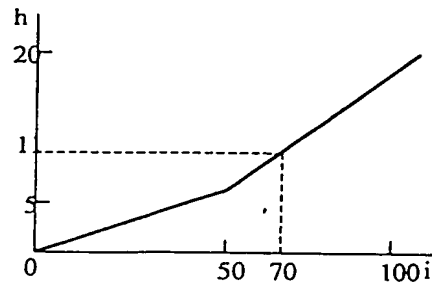


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Fig. 16

図16 i-h テーブル

i	h
0	0
50	5
100	20



**i = 70 の場合**

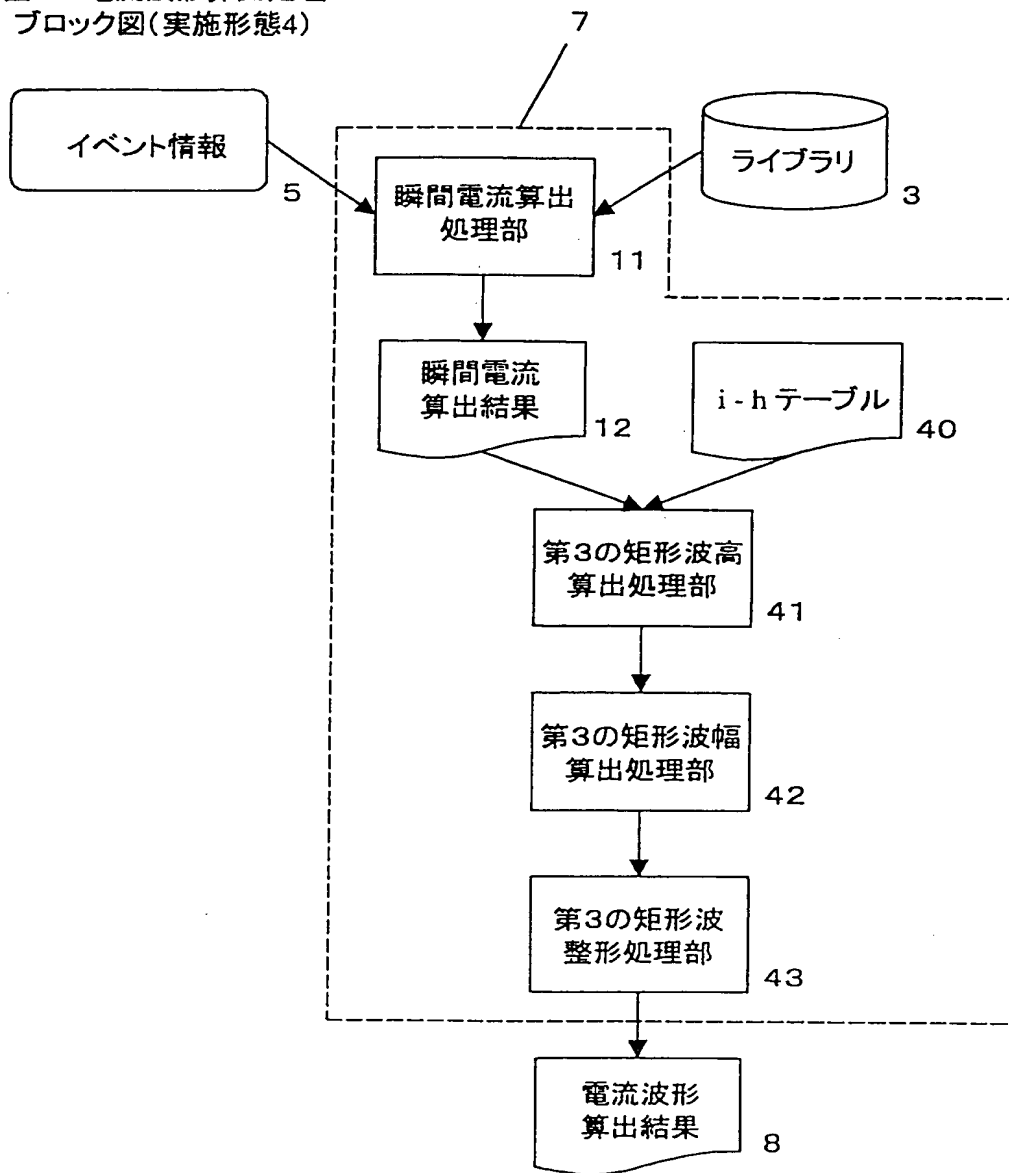
$$(i_1, h_1) = (50, 5)$$
$$(i_2, h_2) = (100, 20)$$

$$h(i) = \frac{h_2 - h_1}{i_2 - i_1} (i - i_1) + h_1$$

$$h(70)=11$$

Fig. 17

図17 電流波形算出処理  
 ブロック図(実施形態4)



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Fig. 19

図19 電流波形算出結果(実施形態4)

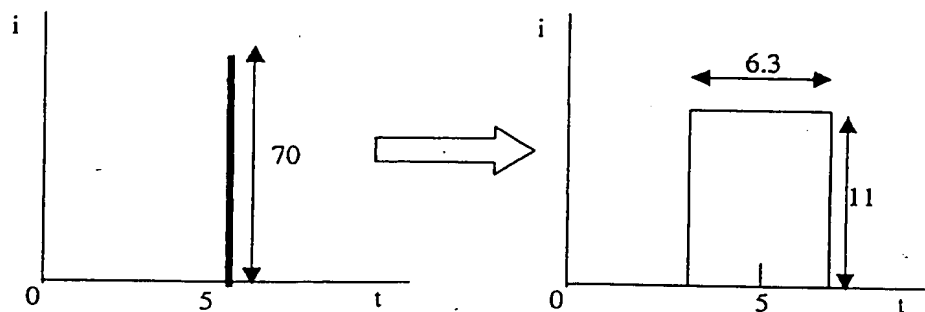
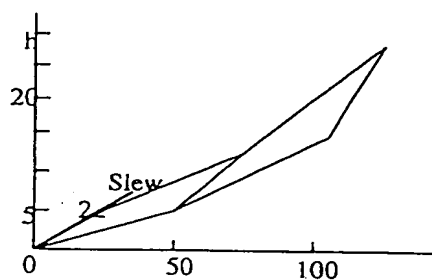


Fig. 20

図 20 i-s-h テーブル

s \ i	0	50	100
0	0	5	14
2	0	6	20



$i = 70, s = 1$  の場合

$s1 = 0, s2 = 2, i1 = 50, i2 = 100$

$h(s1, i1) = 5, h(s1, i2) = 14$

$h(s2, i1) = 6, h(s2, i2) = 20$

$$h(s, i) = \left( \frac{h(s1, i1)(s2 - s)}{(s2 - s1)} + \frac{h(s2, i1)(s - s1)}{(s2 - s1)} \right) \left( \frac{i2 - i}{i2 - i1} \right) + \left( \frac{h(s1, i2)(s2 - s)}{(s2 - s1)} + \frac{h(s2, i2)(s - s1)}{(s2 - s1)} \right) \left( \frac{i - i1}{i2 - i1} \right)$$

$h(1, 70) = 10.1$

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図21 電流波形算出処理  
ブロック図(実施形態5)

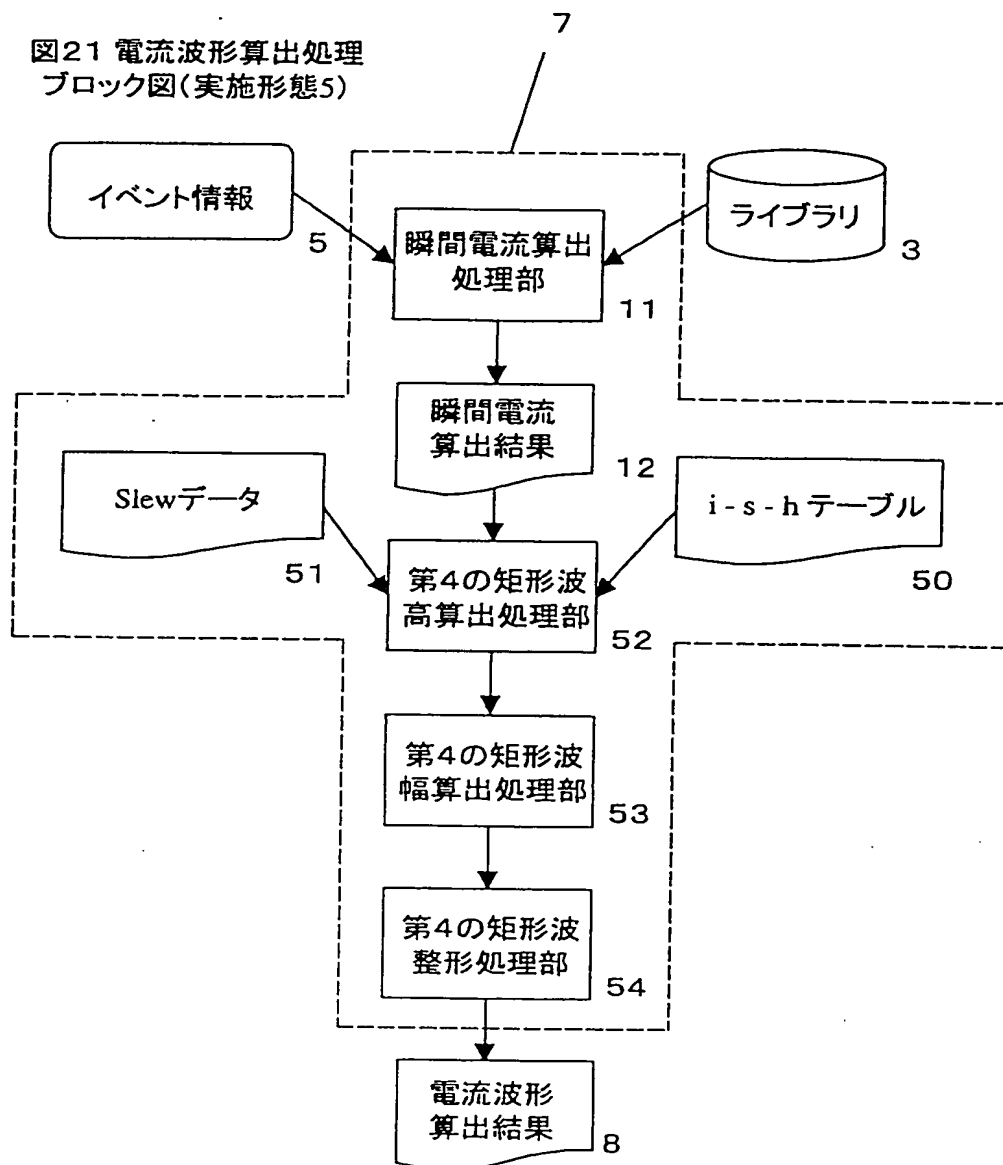
[illegible]



Fig. 22

図22 第4の矩形波整形処理フロー図

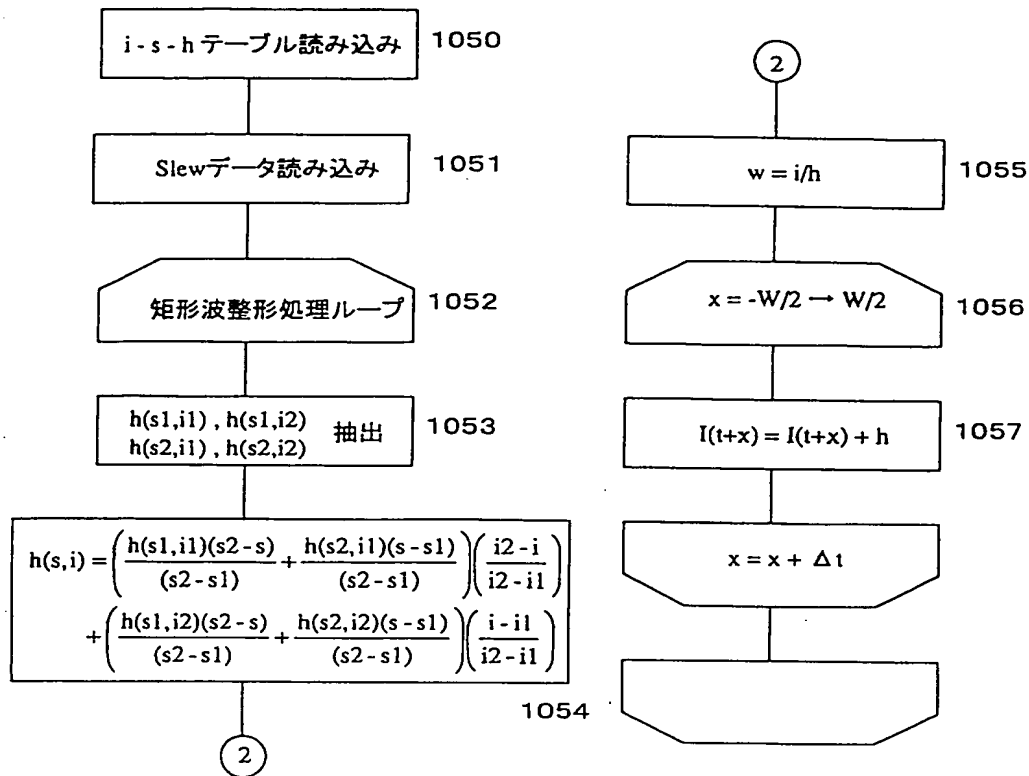


Fig. 23

図23 電流波形算出結果(実施形態5)

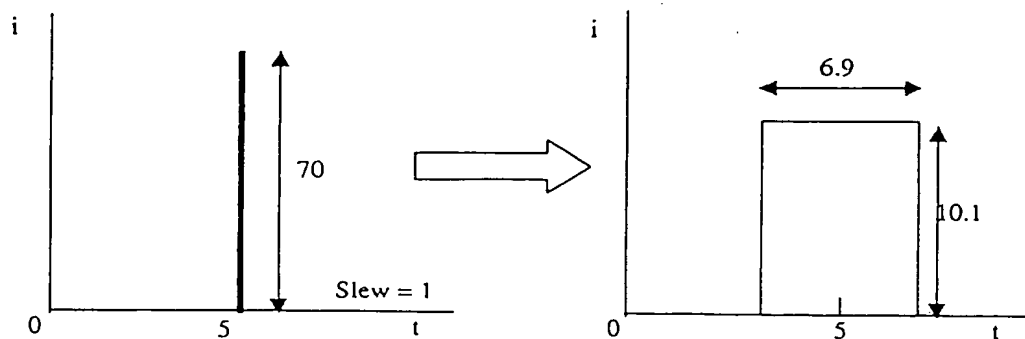
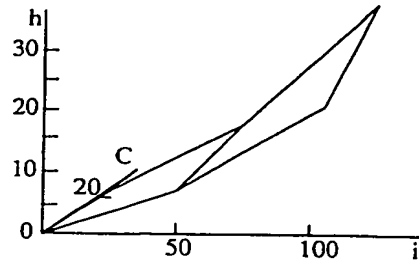


Fig. 24

図24 i - c - h テーブル

c \ i	0	50	100
0	0	5	20
20	0	8	25



i = 70, c = 10 の場合

$$c1 = 0, c2 = 20, i1 = 50, i2 = 100$$

$$h(c1, i1) = 5, h(c1, i2) = 20$$

$$h(c2, i1) = 8, h(c2, i2) = 25$$

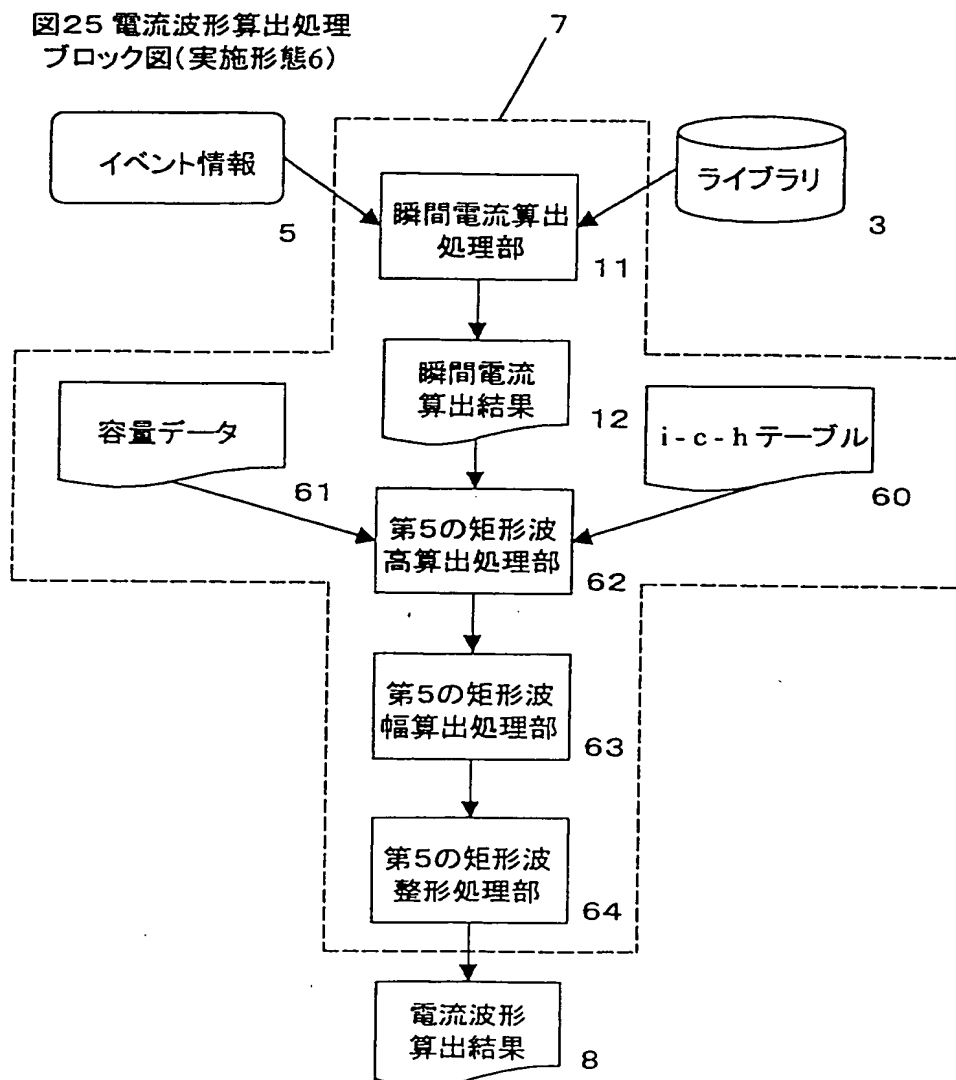
$$h(s, i) = \left( \frac{h(c1, i1)(c2 - c)}{(c2 - c1)} + \frac{h(c2, i1)(c - c1)}{(c2 - c1)} \right) \left( \frac{i2 - i}{i2 - i1} \right) + \left( \frac{h(c1, i2)(c2 - c)}{(c2 - c1)} + \frac{h(c2, i2)(c - c1)}{(c2 - c1)} \right) \left( \frac{i - i1}{i2 - i1} \right)$$

$$h(10, 70) = 12.9$$

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Fig. 25

図25 電流波形算出処理  
ブロック図(実施形態6)



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Fig. 26

図26 第5の矩形波整形処理フロー図

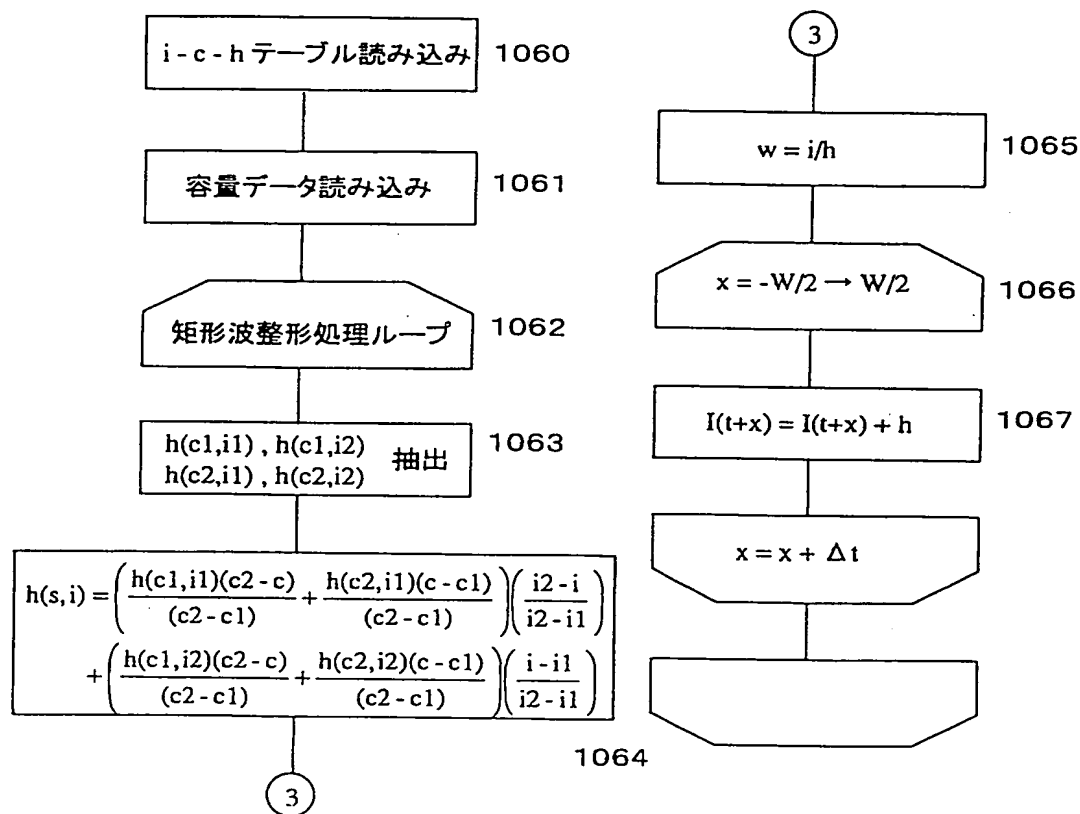


Fig. 27

図27 電流波形算出結果(実施形態6)

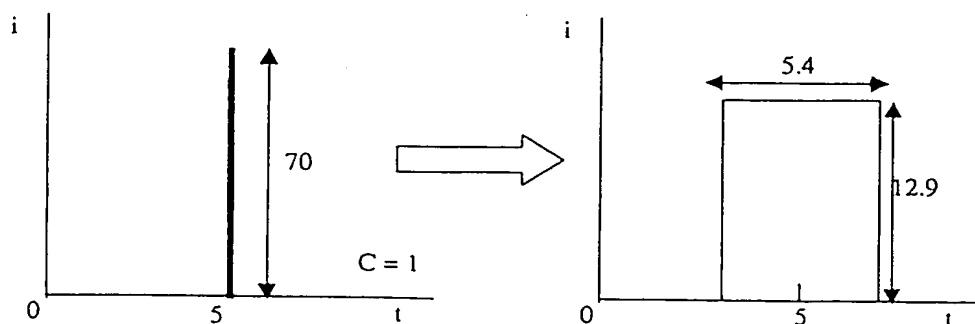
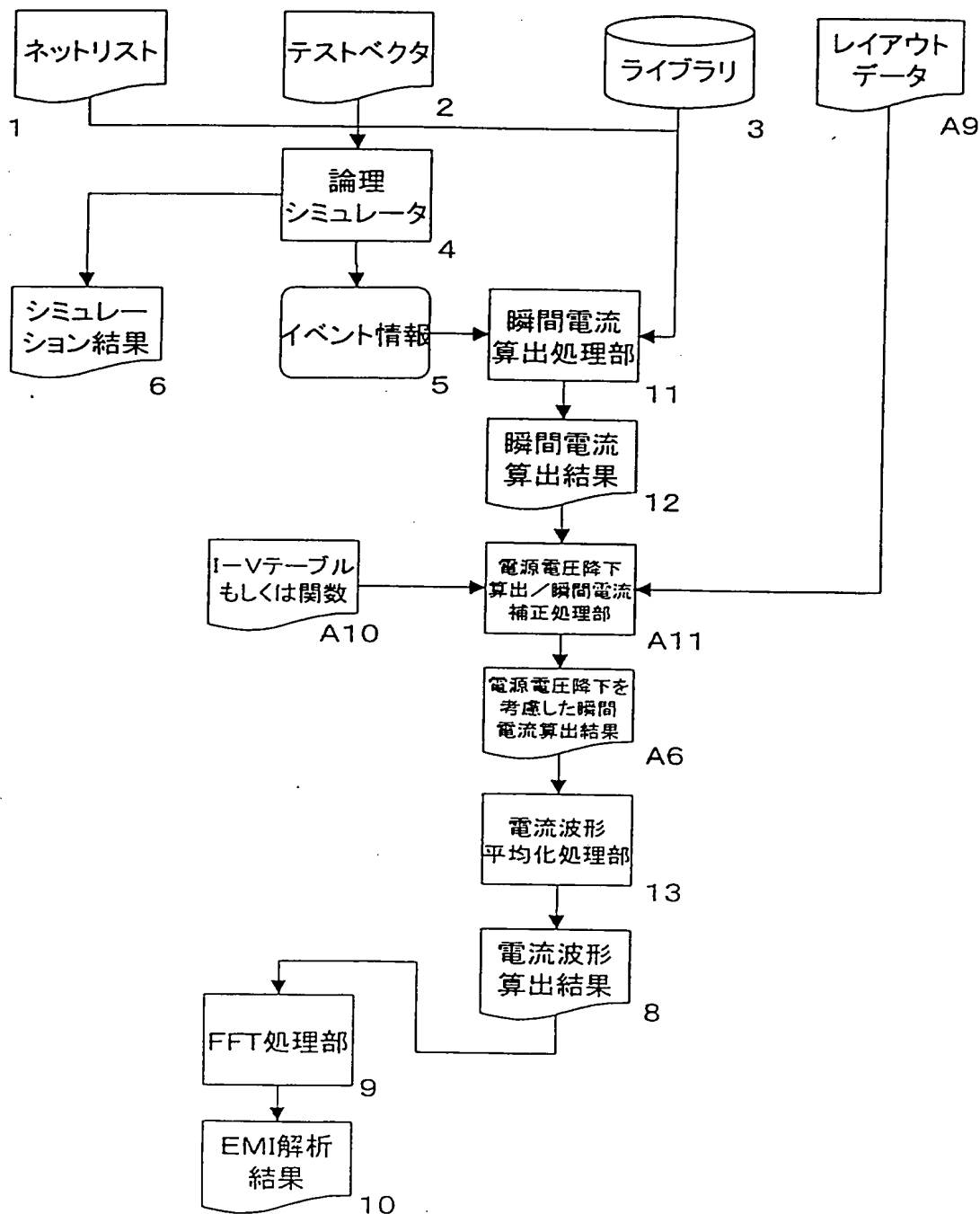
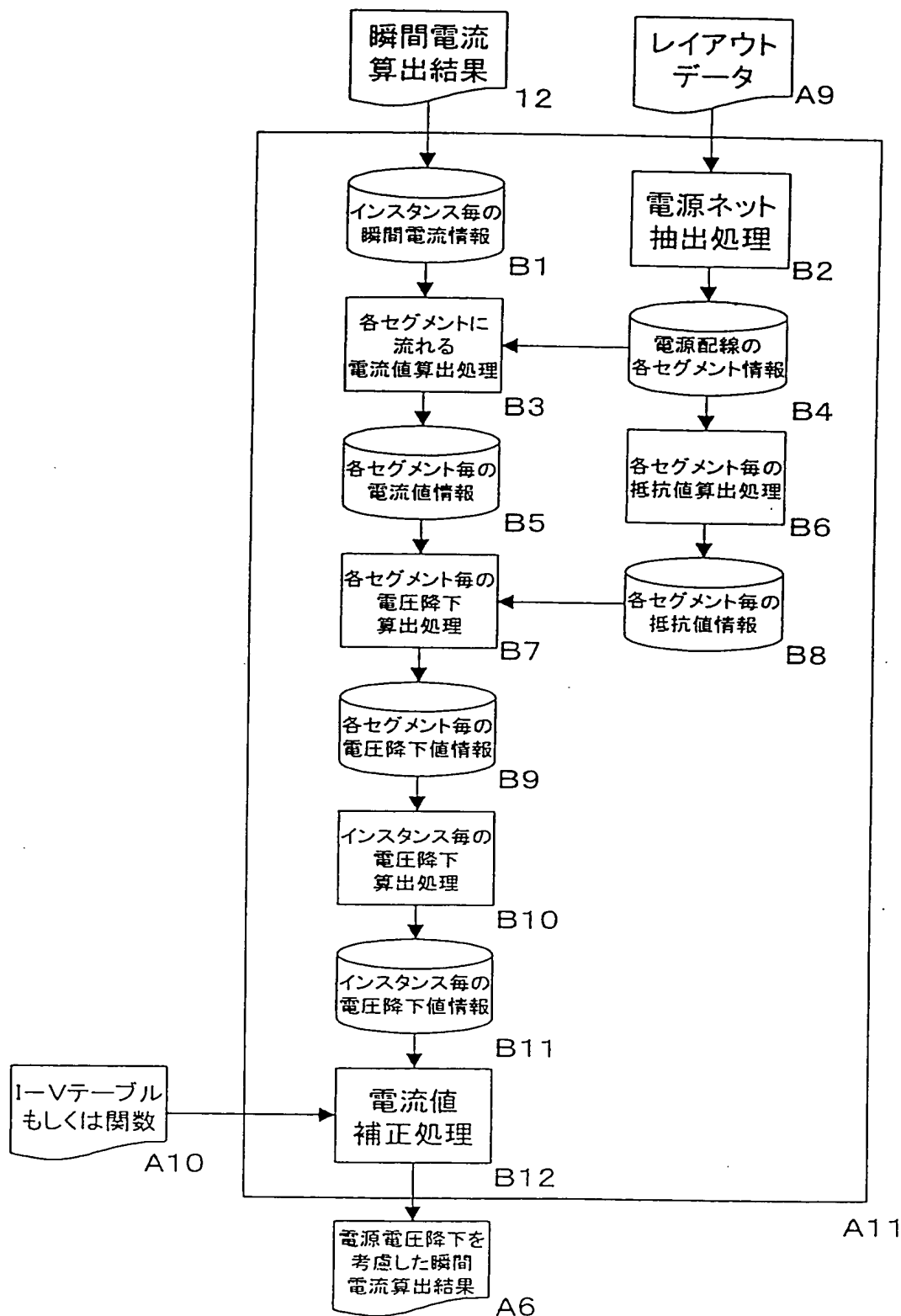


Fig. 28



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Fig. 29



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Fig. 30

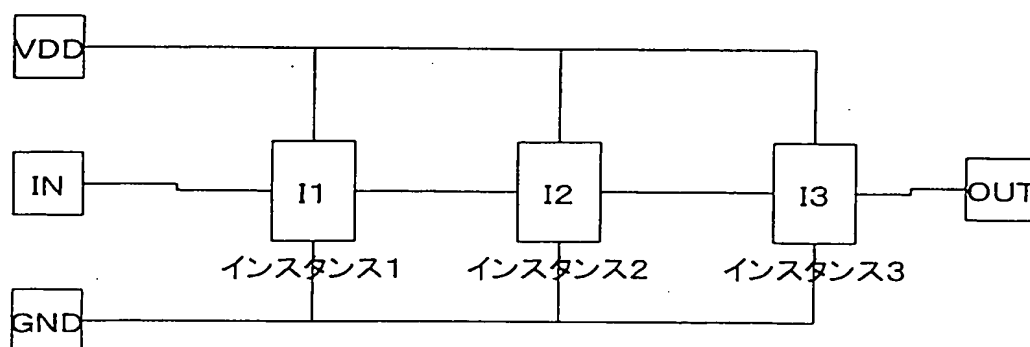


Fig. 31

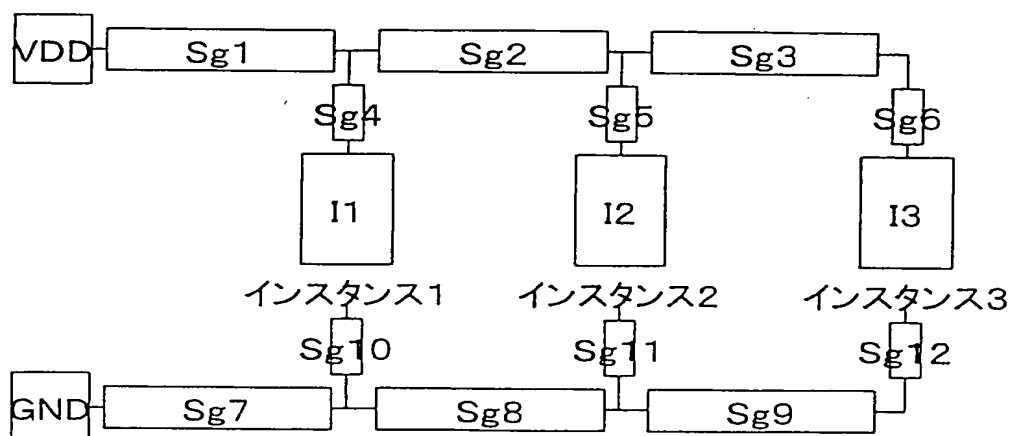
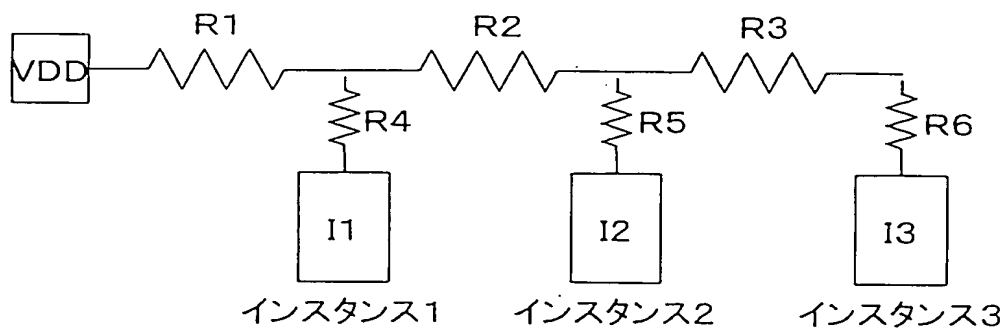
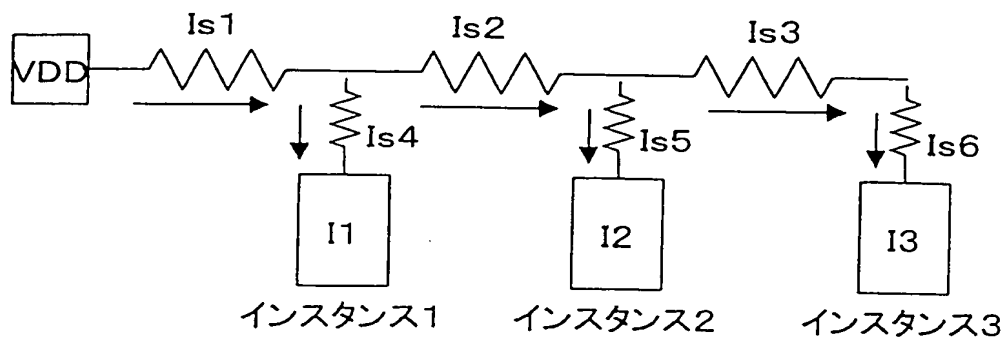


Fig. 32



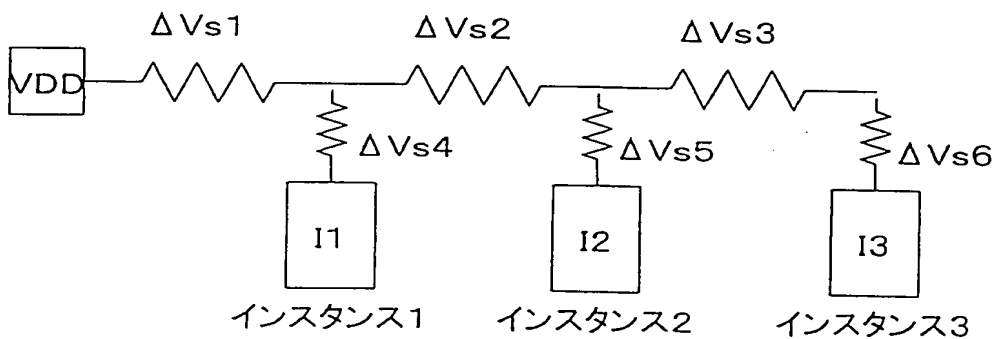
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Fig. 33



$$\begin{aligned} Is1 &= I1 + I2 + I3 \\ Is2 &= I2 + I3 \\ Is3 &= I3 \\ Is4 &= I1 \\ Is5 &= I2 \\ Is6 &= I3 \end{aligned}$$

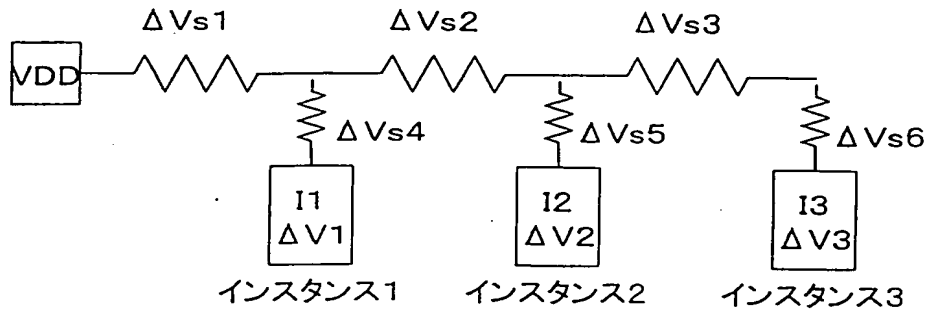
Fig. 34



$$\begin{aligned} \Delta Vs1 &= R1 * Is1 \\ \Delta Vs2 &= R2 * Is2 \\ \Delta Vs3 &= R3 * Is3 \\ \Delta Vs4 &= R4 * Is4 \\ \Delta Vs5 &= R5 * Is5 \\ \Delta Vs6 &= R6 * Is6 \end{aligned}$$



Fig. 35

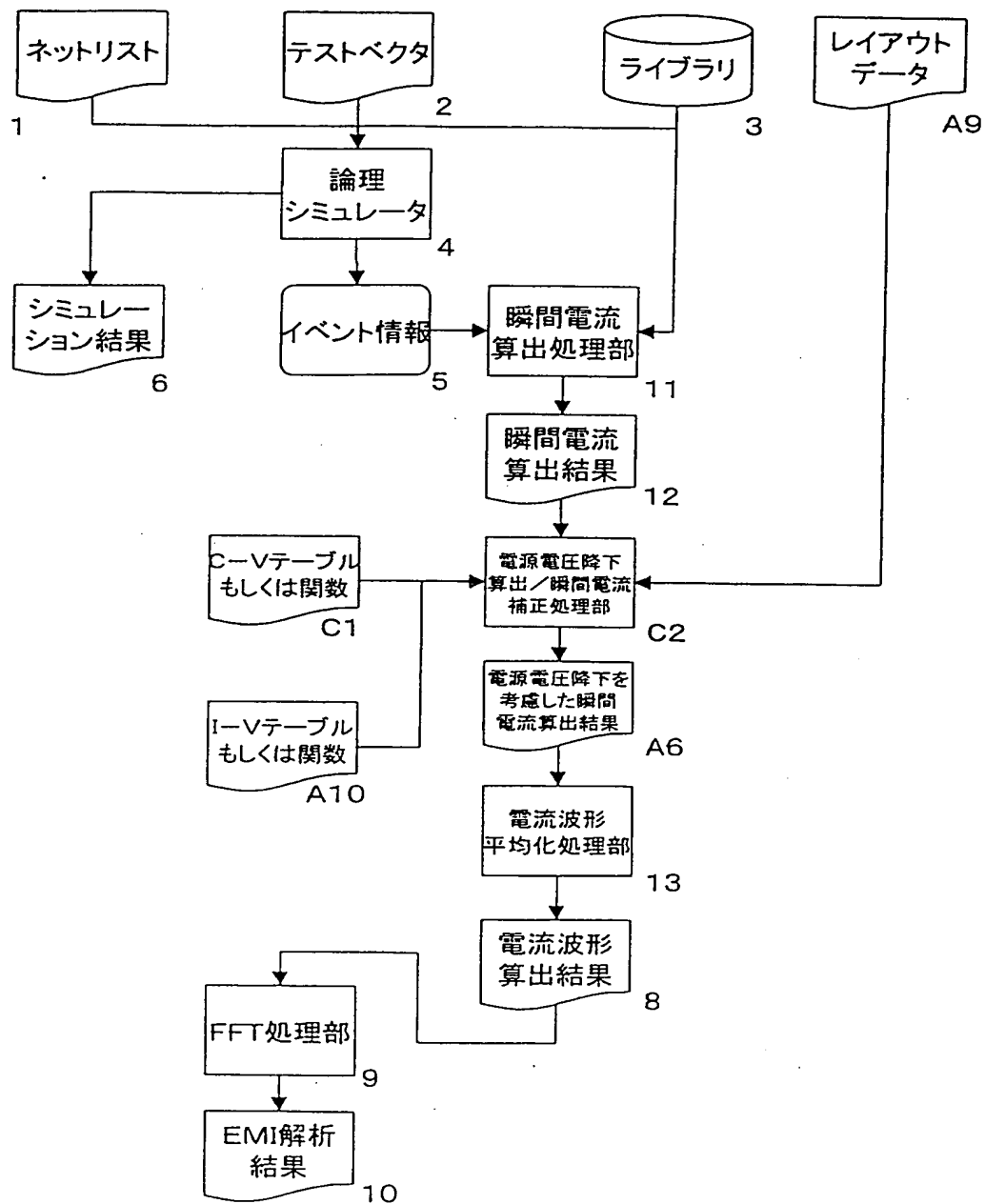


インスタンス1の電圧降下:  $\Delta V1 = \Delta V_{s1} + \Delta V_{s4}$

インスタンス2の電圧降下:  $\Delta V2 = \Delta V_{s1} + \Delta V_{s2} + \Delta V_{s5}$

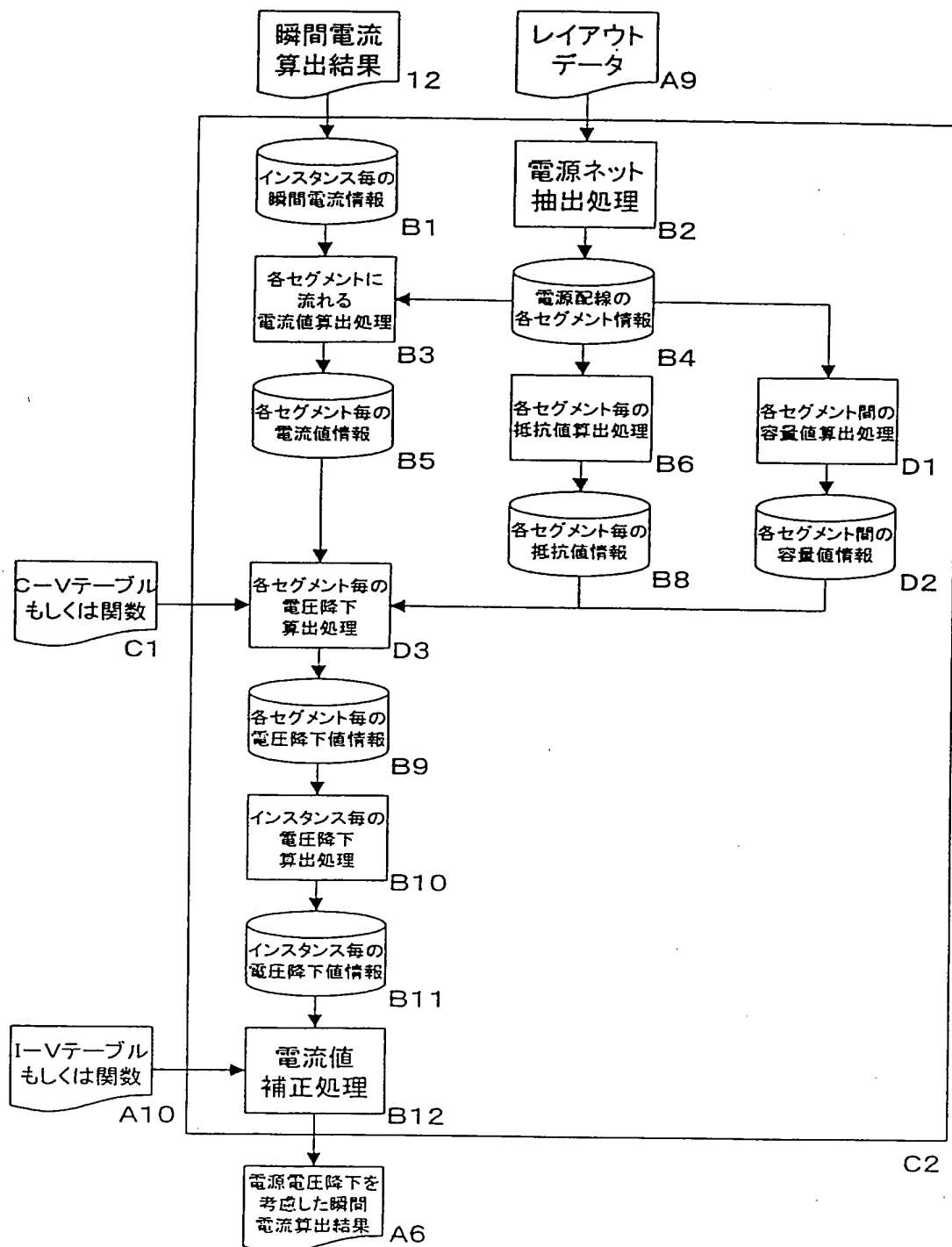
インスタンス3の電圧降下:  $\Delta V3 = \Delta V_{s1} + \Delta V_{s2} + \Delta V_{s3} + \Delta V_{s6}$

Fig. 36



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Fig. 37



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Fig. 38

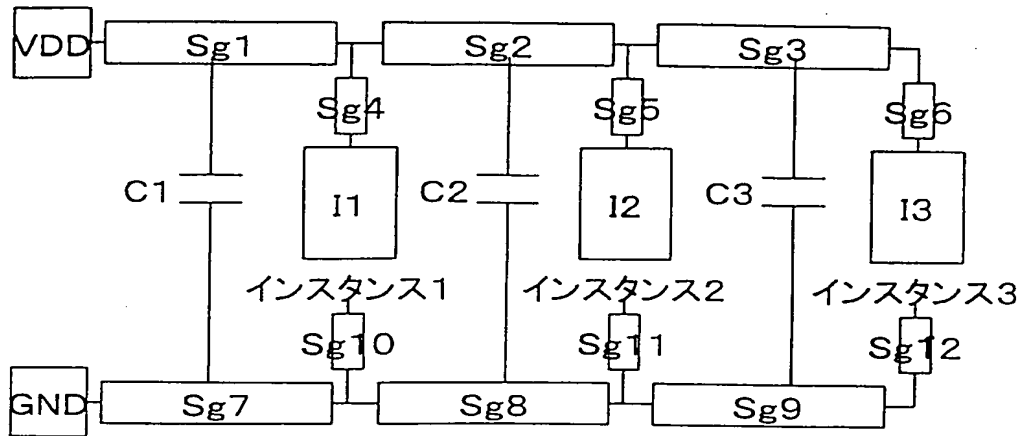
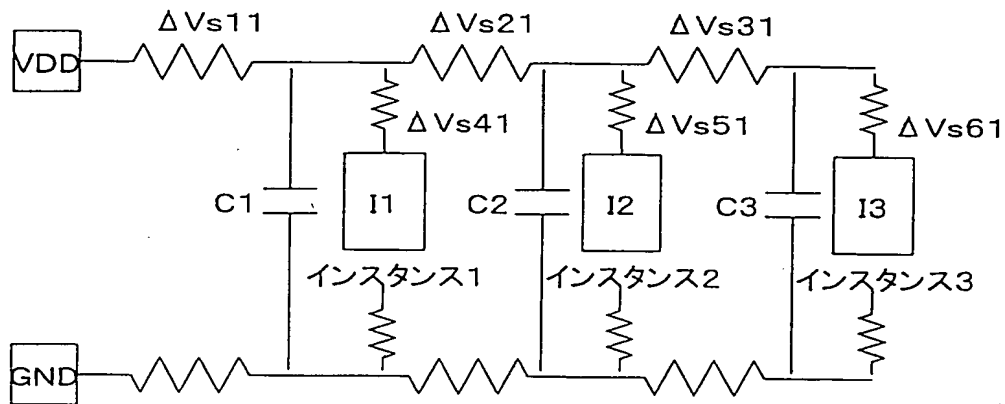


Fig. 39



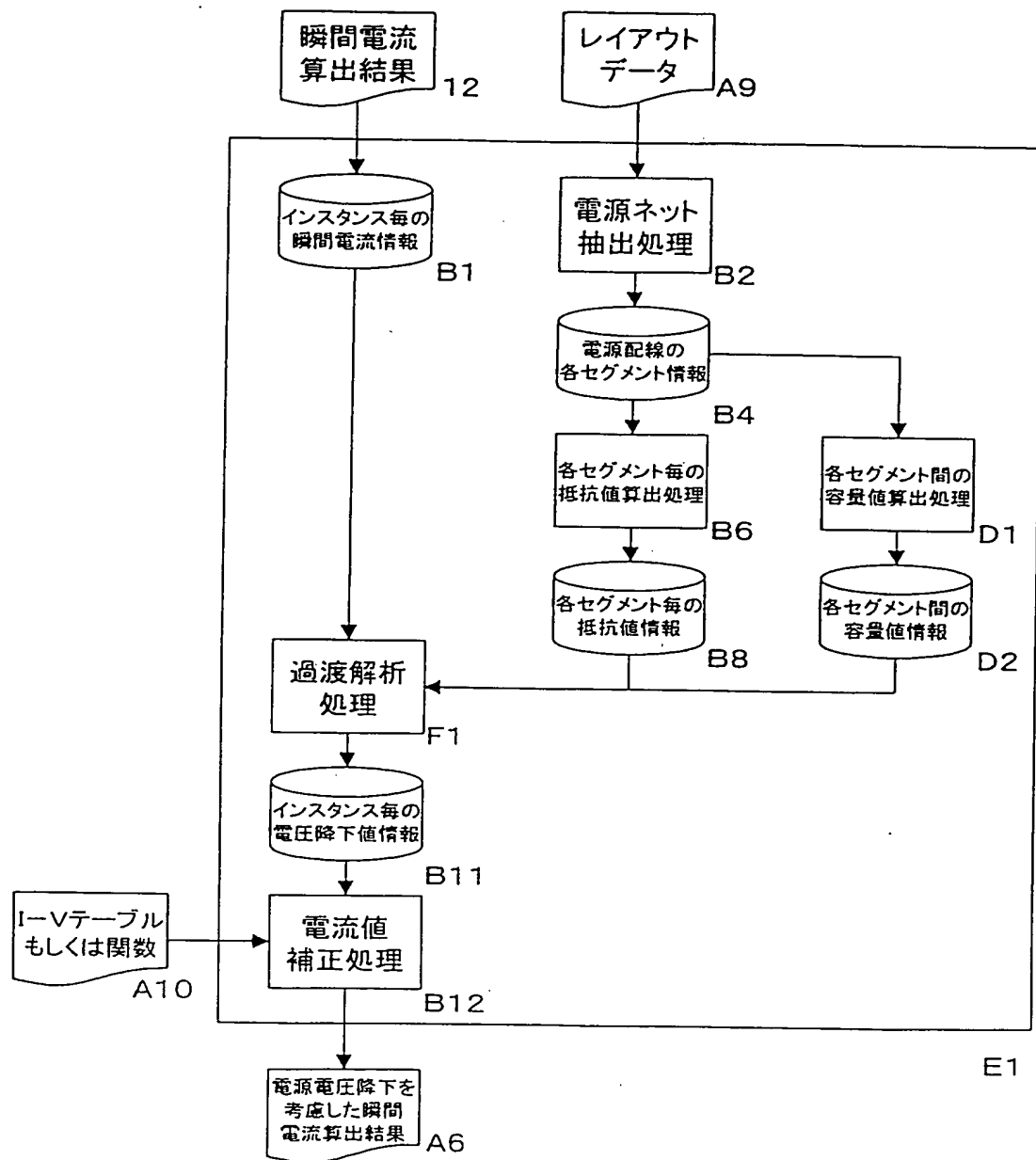
$$\begin{aligned}\Delta V_{s11} &= f(C1, \Delta V_{s1}) \\ \Delta V_{s21} &= f(C2, \Delta V_{s2}) \\ \Delta V_{s31} &= f(C3, \Delta V_{s3}) \\ \Delta V_{s41} &= \Delta V_{s4} \\ \Delta V_{s51} &= \Delta V_{s5} \\ \Delta V_{s61} &= \Delta V_{s6}\end{aligned}$$



インスタンス1の電圧降下:  $\Delta V1 = \Delta V_{s11} + \Delta V_{s41}$   
 インスタンス2の電圧降下:  $\Delta V2 = \Delta V_{s11} + \Delta V_{s21} + \Delta V_{s51}$   
 インスタンス3の電圧降下:  $\Delta V3 = \Delta V_{s11} + \Delta V_{s21} + \Delta V_{s31} + \Delta V_{s61}$



Fig. 41



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Fig. 42

図42 三角波モデル(実施形態10)

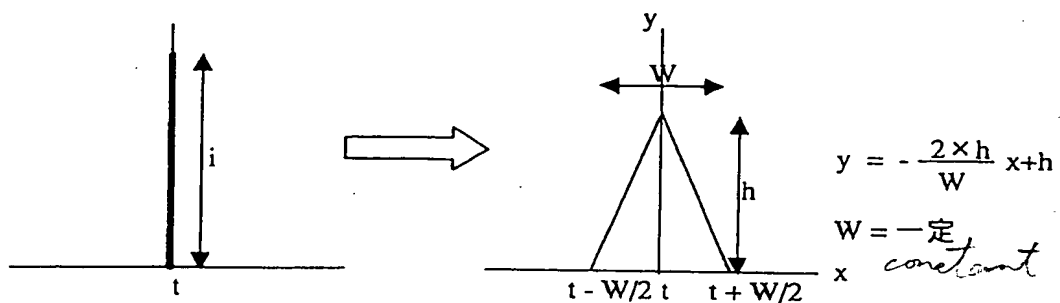
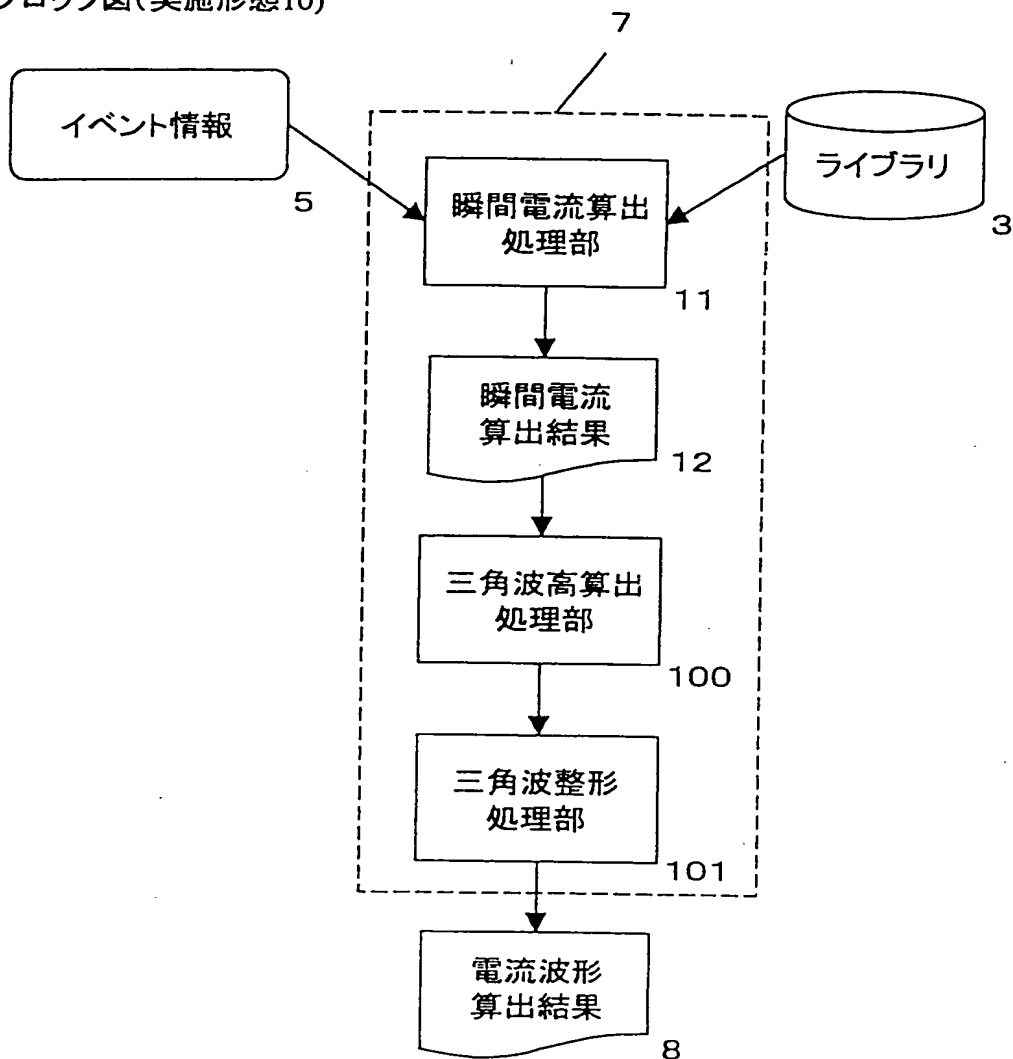


Fig. 43

図43 電流波形算出処理  
ブロック図(実施形態10)



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図44 三角波整形処理フロー図

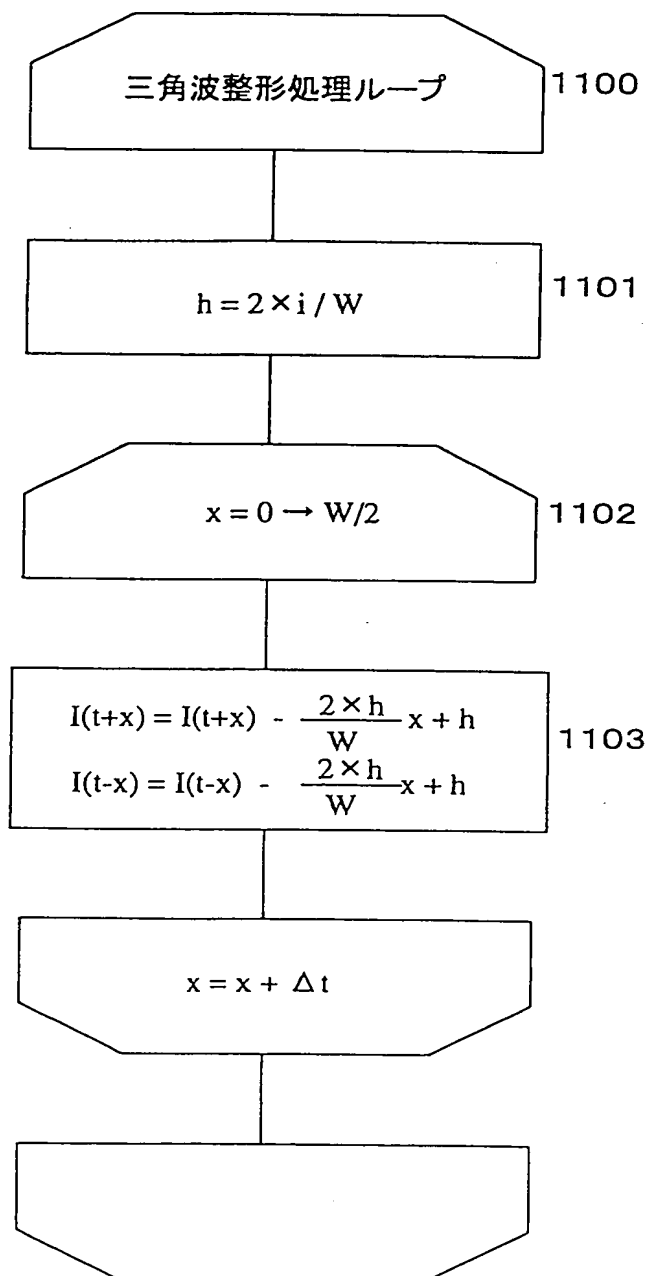
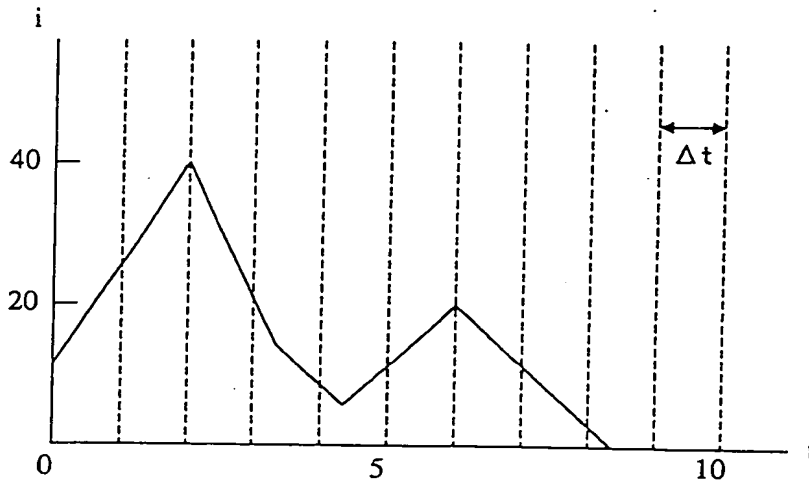
[illegible]

Fig. 45

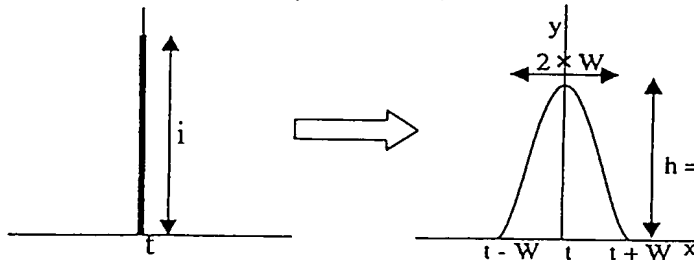
図45 電流波形算出結果(実施形態10)



W = 5 の時

Fig. 46

図46 複数次関数モデル(実施形態11)



W = 一定

$$y = a(x - W)^2(x + W)^2$$

$$a = \frac{15}{16 \times W^5} i$$

W = 2.5, i = 100 の時

a = 0.96

h = 37.5

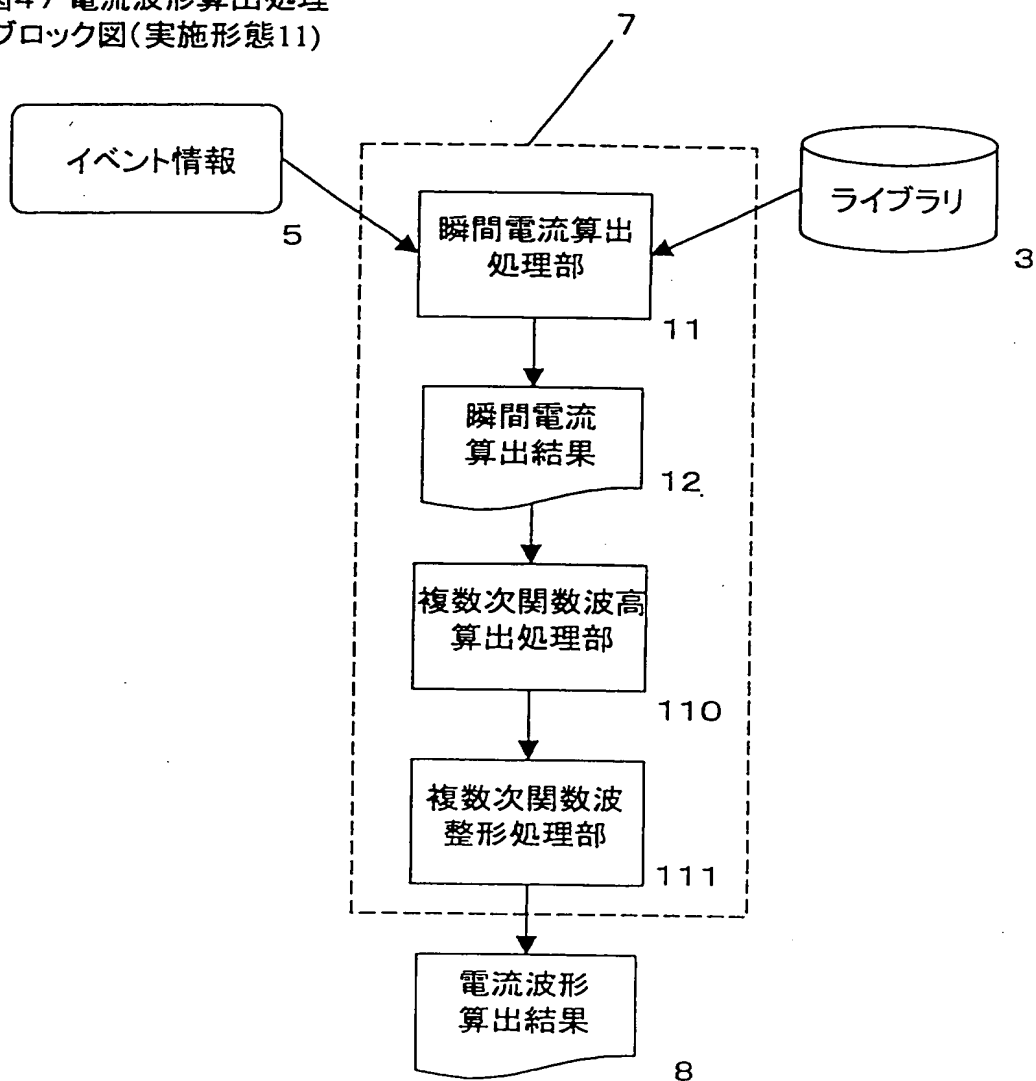
W = 2.5, i = 50 の時

a = 0.48

h = 18.75

Fig. 47

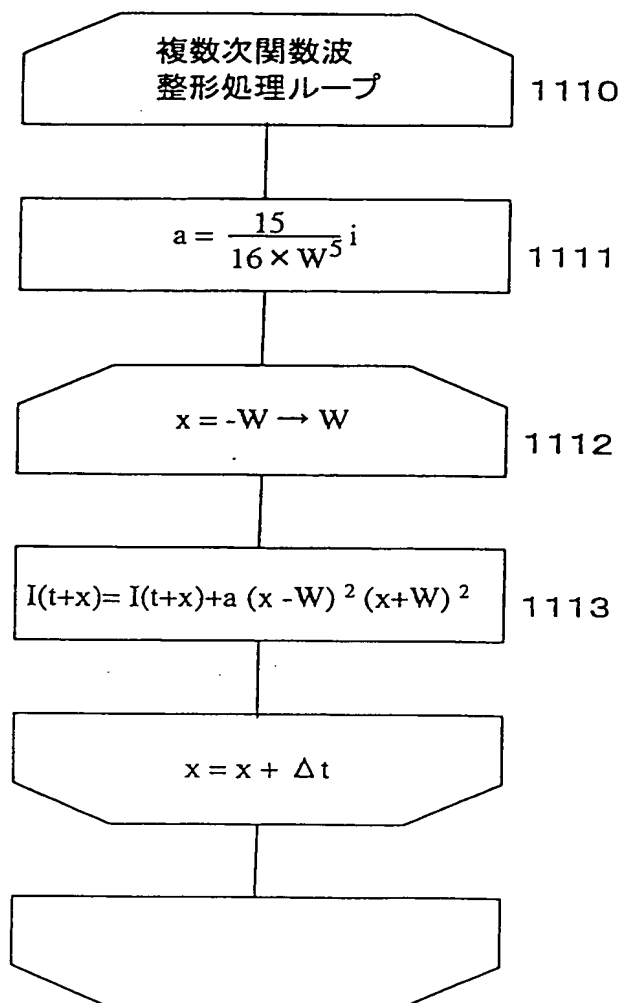
図47 電流波形算出処理  
 ブロック図(実施形態11)



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Fig. 48

図48 複数次関数波整形処理フロー図



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Fig. 49

図49 電流波形算出結果(実施形態11)

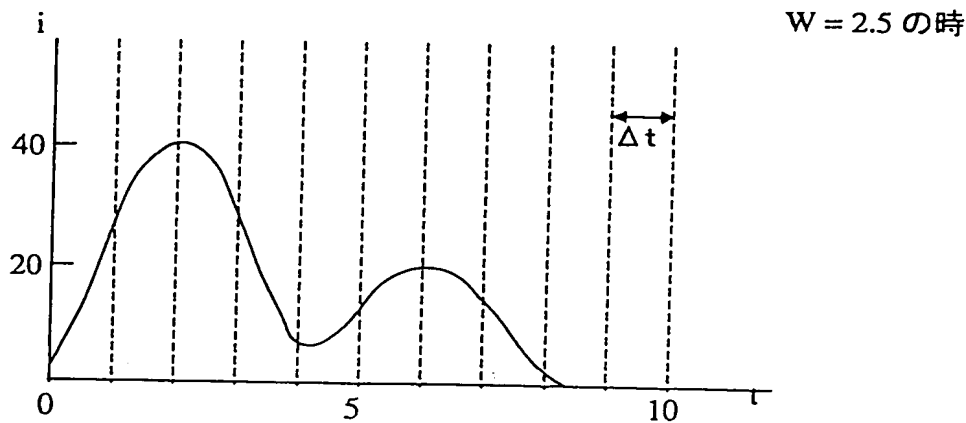


Fig. 50

図50 ガウス関数モデル(実施形態12,25)

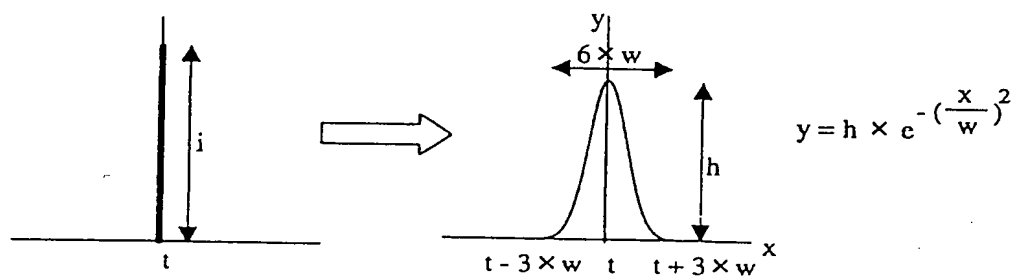
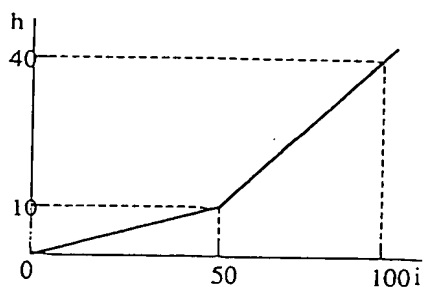


Fig. 51

図51 i-h テーブル

i	h
0	0
50	10
100	40



i = 50, 100 の場合  
(i1, h1) = (50, 5)  
(i2, h2) = (100, 20)

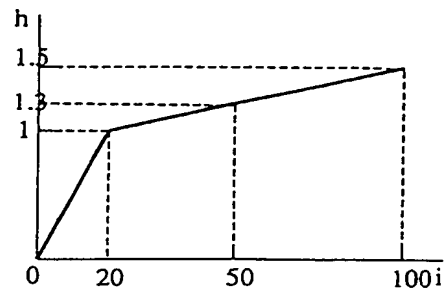
$$h(i) = \frac{h_2 - h_1}{i_2 - i_1} (i - i_1) + h_1$$

h(50) = 10  
h(100) = 40

Fig. 52

図52 i-w テーブル

i	w
0	0
20	1
100	1.5

 $i = 50, 100$  の場合 $(i_1, w_1) = (20, 1)$  $(i_2, w_2) = (100, 1.5)$ 

$$w(i) = \frac{w_2 - w_1}{i_2 - i_1} (i - i_1) + w_1$$

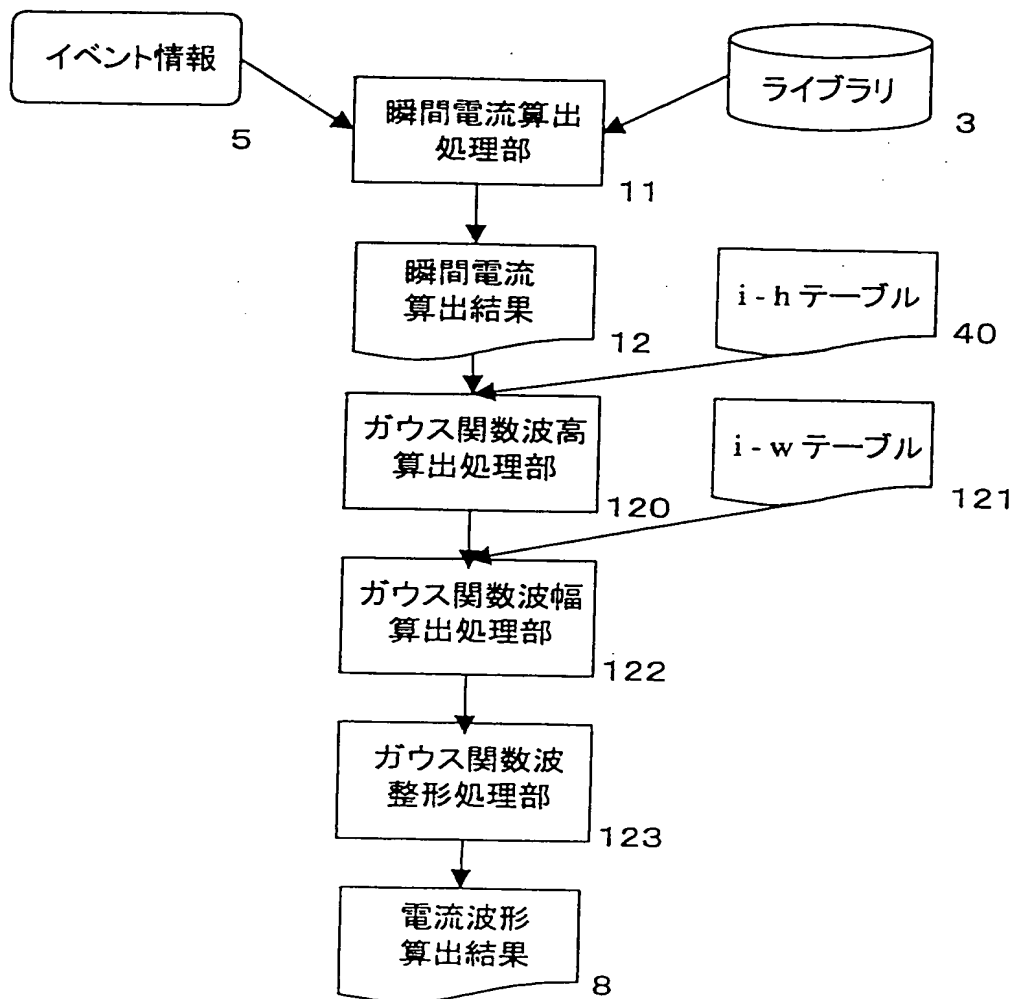
$$w(50) = 1.3$$

$$w(100) = 1.5$$

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Fig. 53

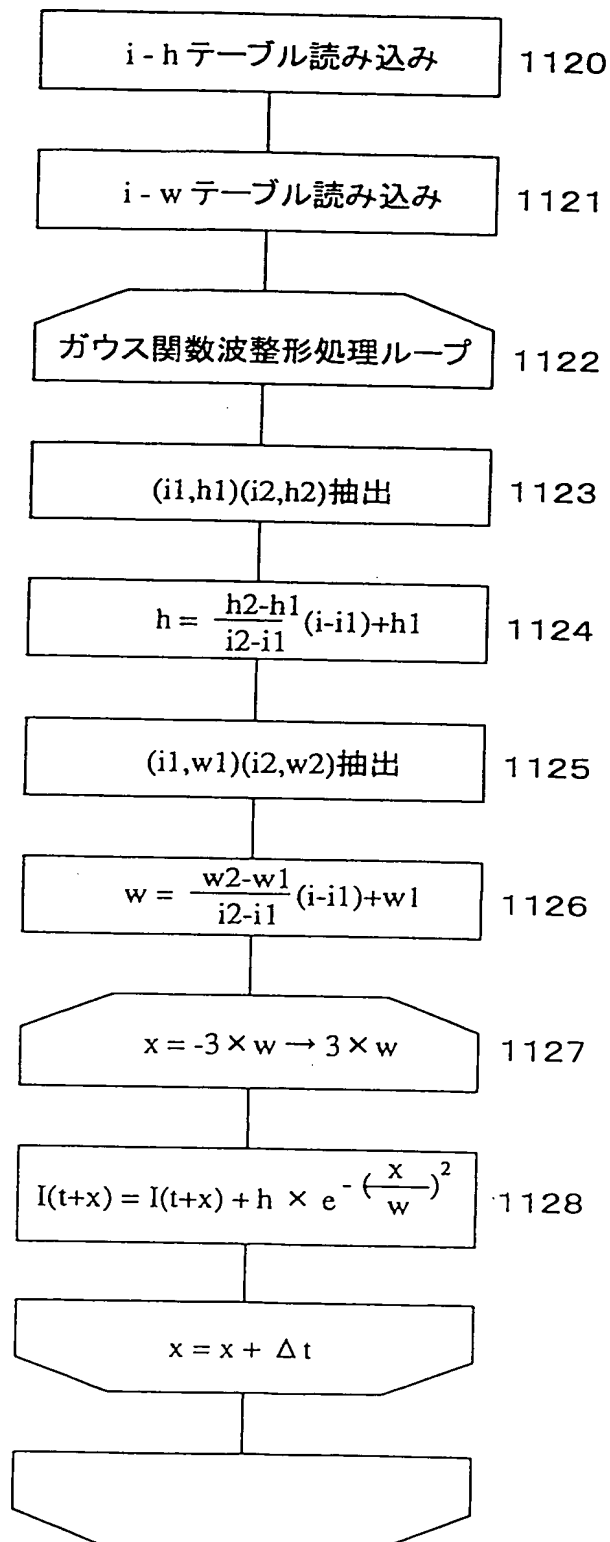
図53 電流波形算出処理  
ブロック図(実施形態12)



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Fig. 54

図54 ガウス波整形処理フロー図

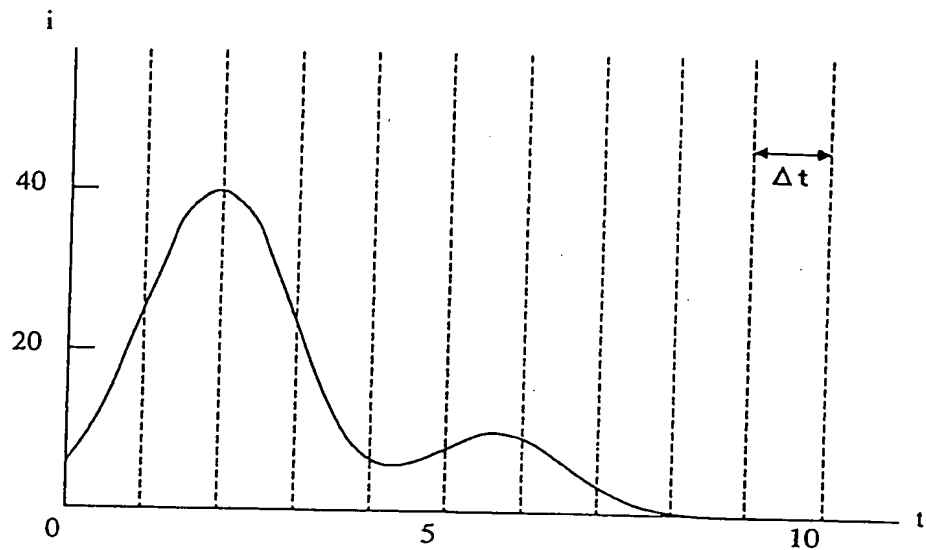


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Fig. 55

図55 電流波形算出結果(実施形態12)



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Fig. 56

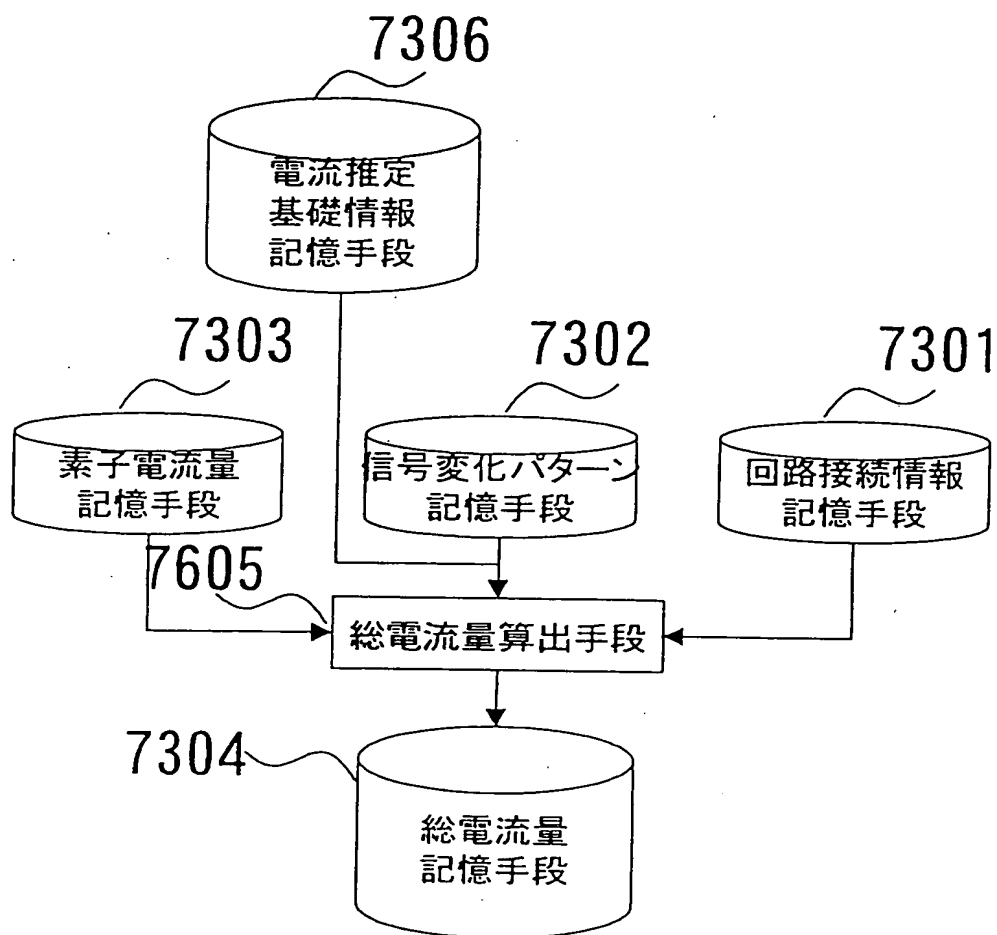


Fig. 57

フリップフロップFF			
Y変化時貫通電流成分電流量	2mA	~	7401
Y変化時チャージ電流成分電流量	3mA	~	7402
CK変化時貫通電流成分電流量	1mA	~	7403
CK変化時チャージ電流成分電流量	1mA	~	7404

バッファBUF			
Y変化時貫通電流成分電流量	0.5mA	~	7405
Y変化時チャージ電流成分電流量	0.5mA	~	7406

Fig. 58

current

電流

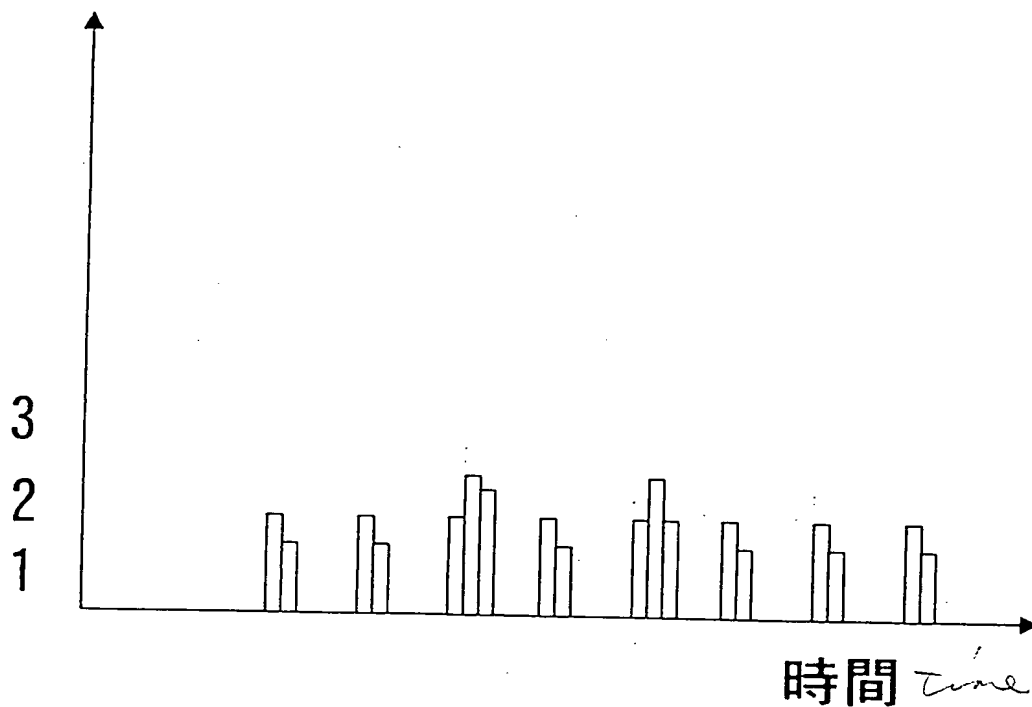


Fig. 59

7601

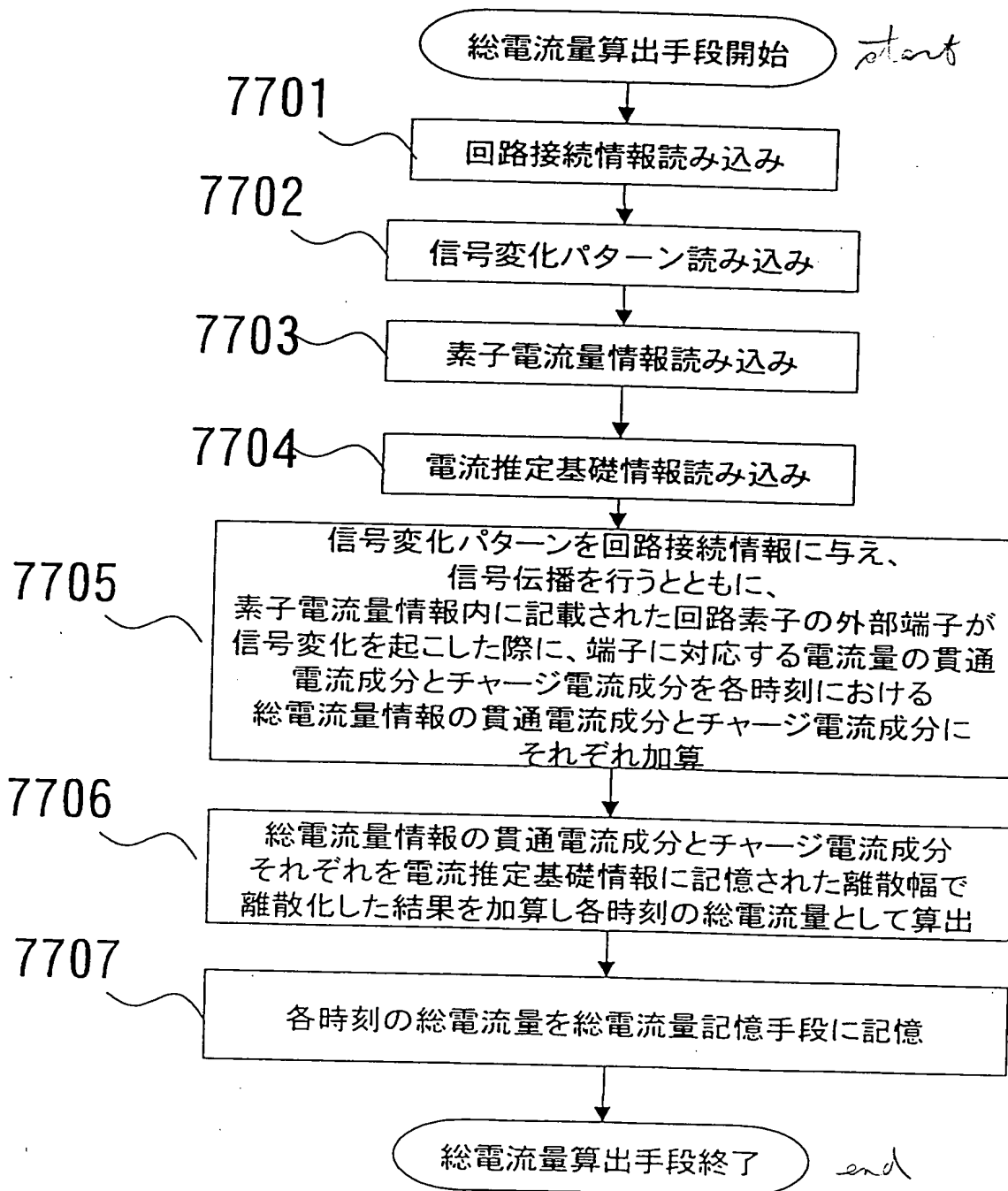
貫通電流成分離散幅 1ns

チャージ電流成分離散幅 3ns

7602

004040"28521960

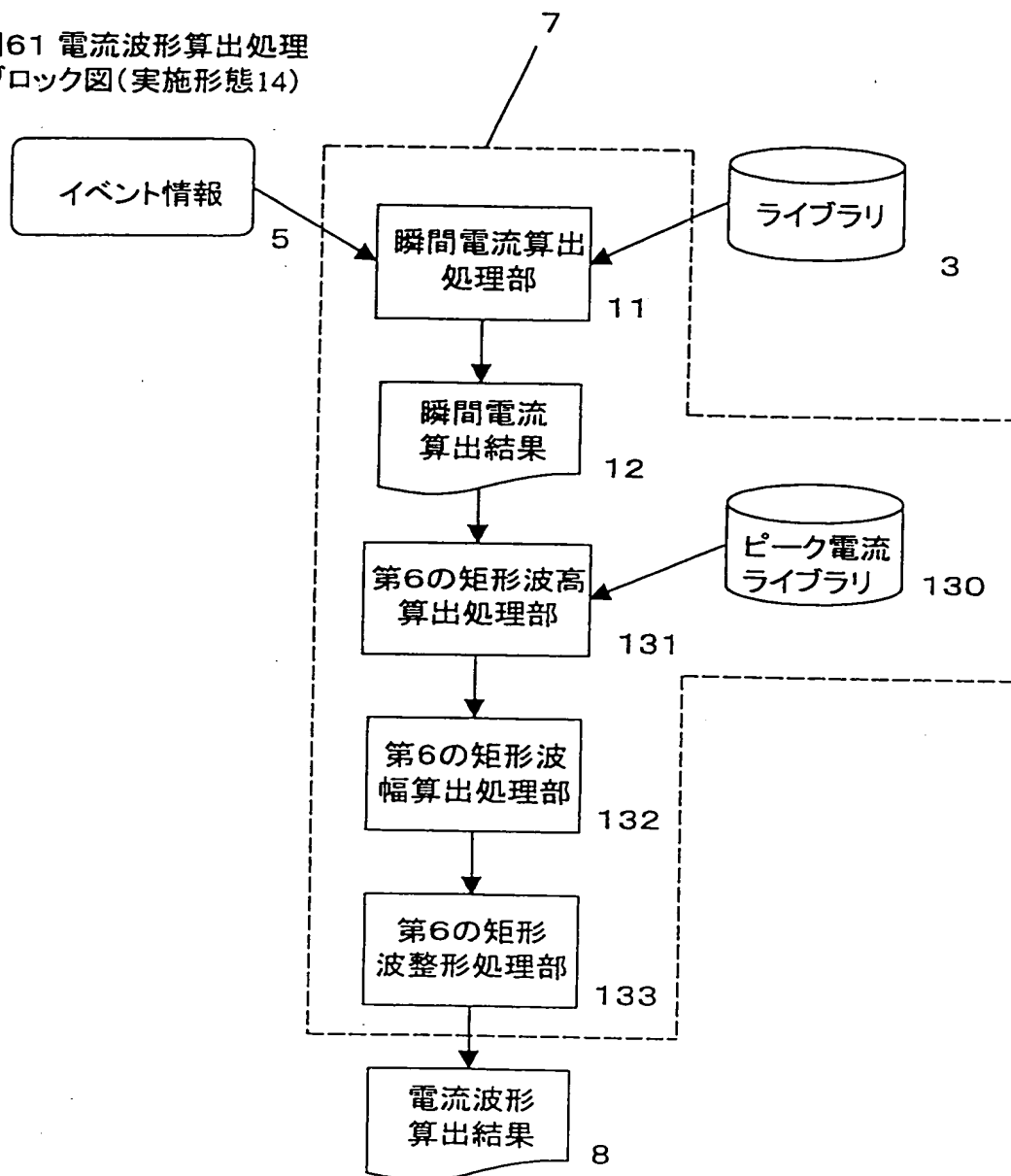
Fig. 60



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Fig. 61

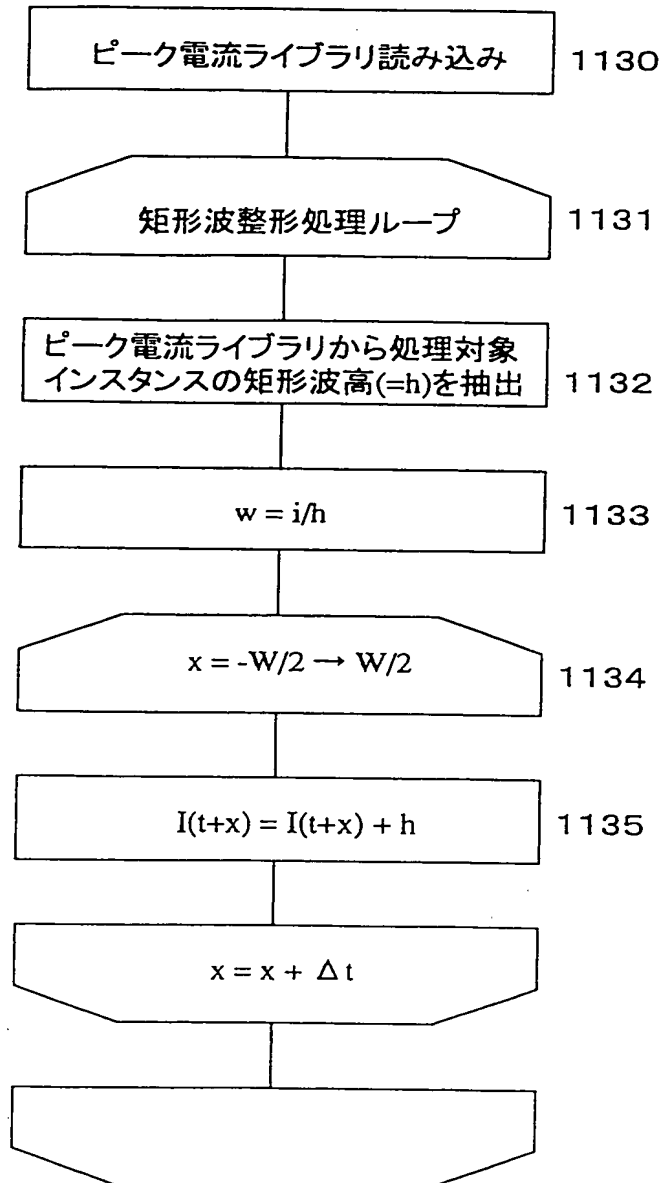
図61 電流波形算出処理  
 ブロック図(実施形態14)



09612582-070700

Fig. 62

図62 第6の矩形波整形処理フロー図

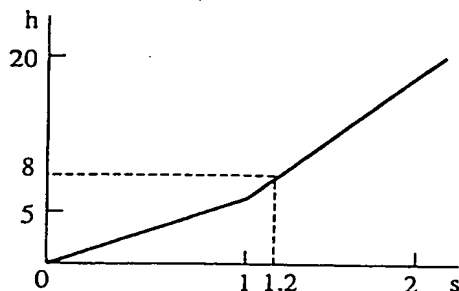


004040"2852T960

Fig. 63

図63 s-h テーブル

s	h
0	0
1	5
2	20



s = 1.2 の場合

(s1, h1) = (1, 5)

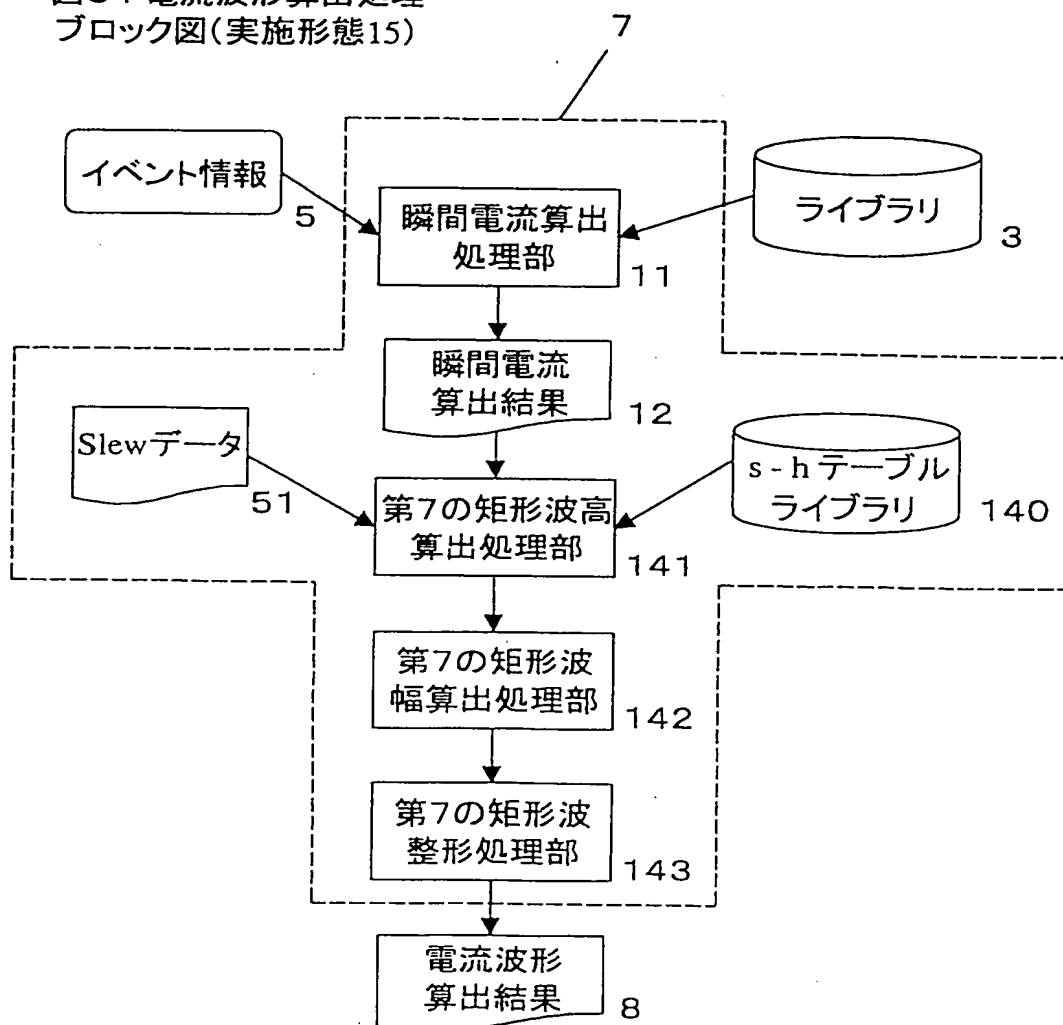
(s2, h2) = (2, 20)

$$h(s) = \frac{h_2 - h_1}{s_2 - s_1} (s - s_1) + h_1$$

$$h(1.2) = 8$$

Fig. 64

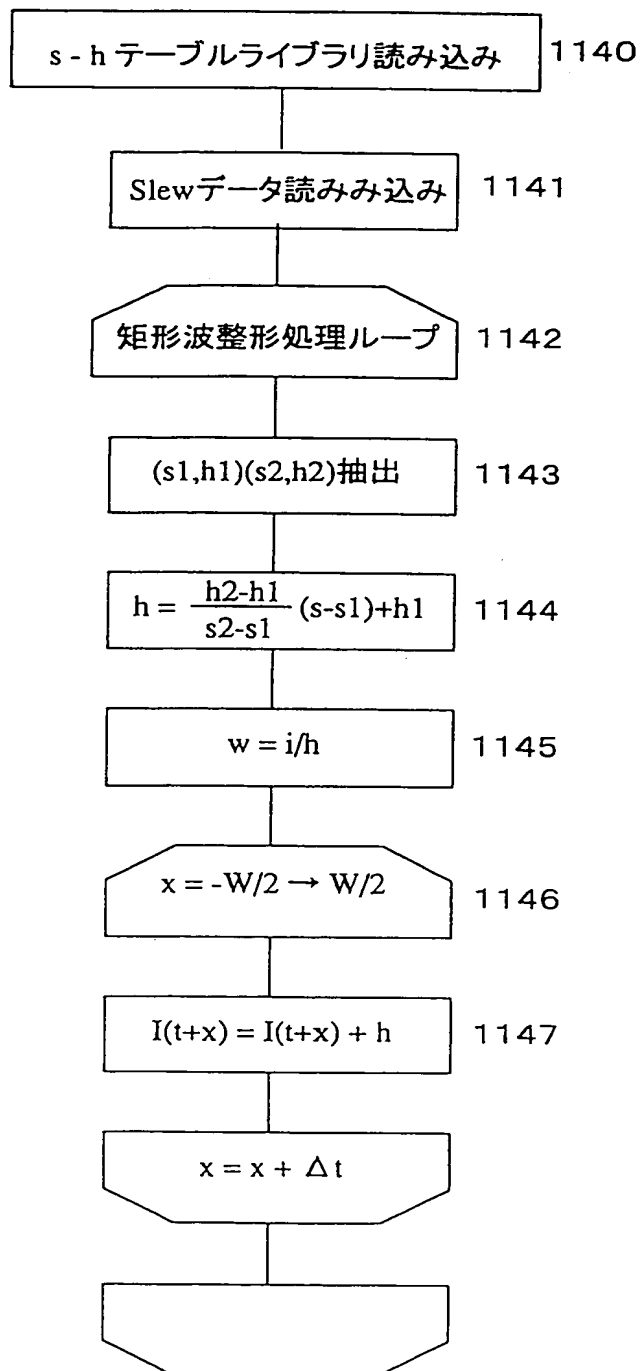
図64 電流波形算出処理  
ブロック図(実施形態15)



00612582-070700

Fig. 65

図65 第7の矩形波整形処理フロー図



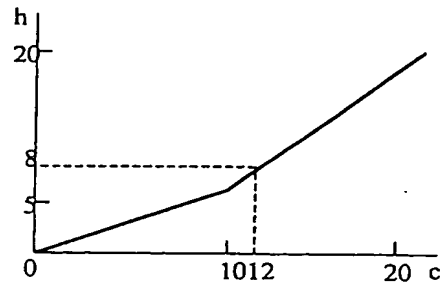
004040"2852T660



Fig. 66

図66 c-h テーブル

c	h
0	0
10	5
20	20



c = 12 の場合  
 $(c1, h1) = (10, 5)$   
 $(c2, h2) = (20, 20)$

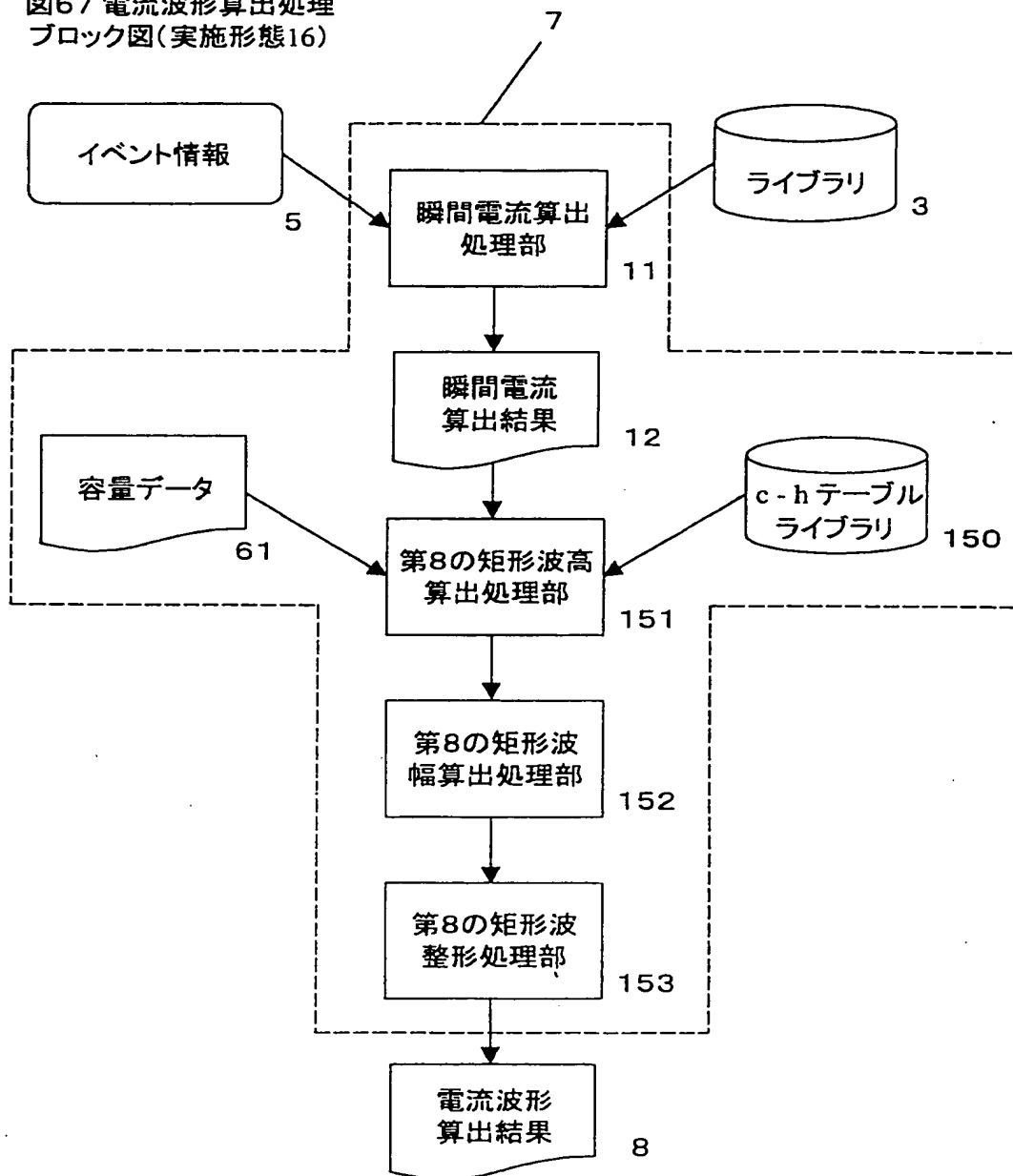
$$h(c) = \frac{h2-h1}{c2-c1}(c-c1)+h1$$

$$h(12)=8$$

004040"2852F960

Fig. 67

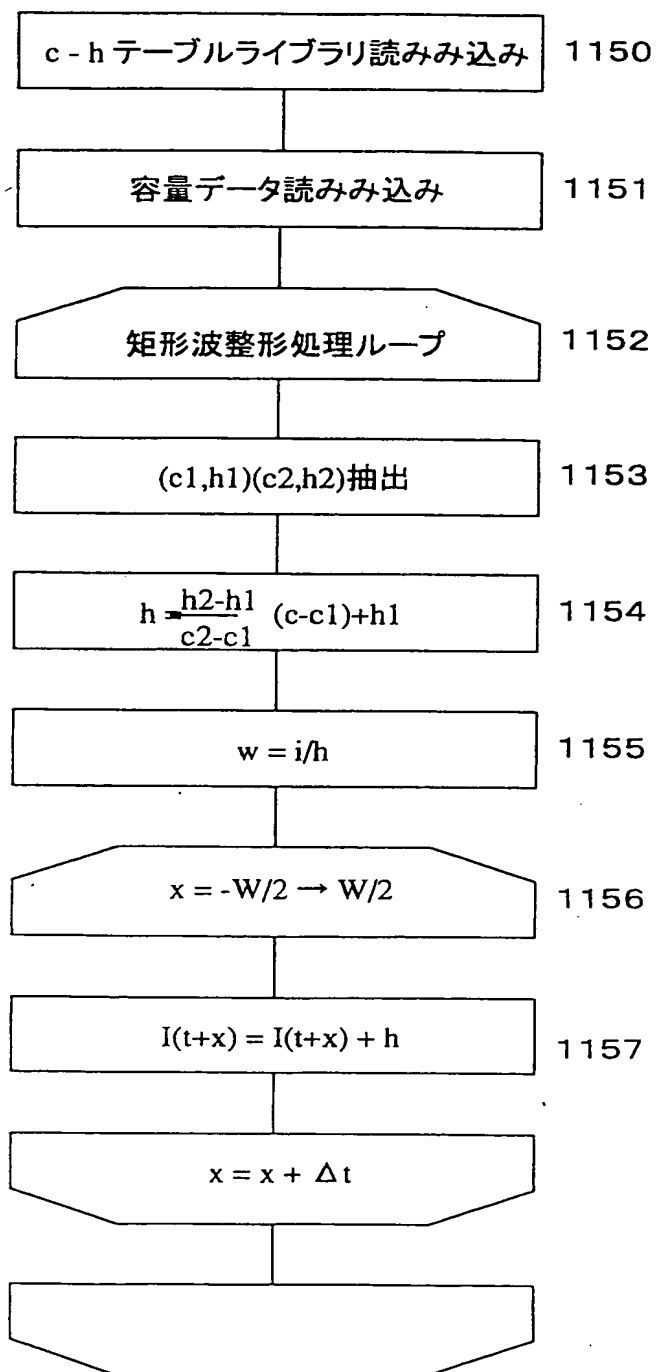
図67 電流波形算出処理  
ブロック図(実施形態16)



007070" 28521960

Fig. 68

図68 第8の矩形波整形処理フロー図



004040"28521960

Fig. 69

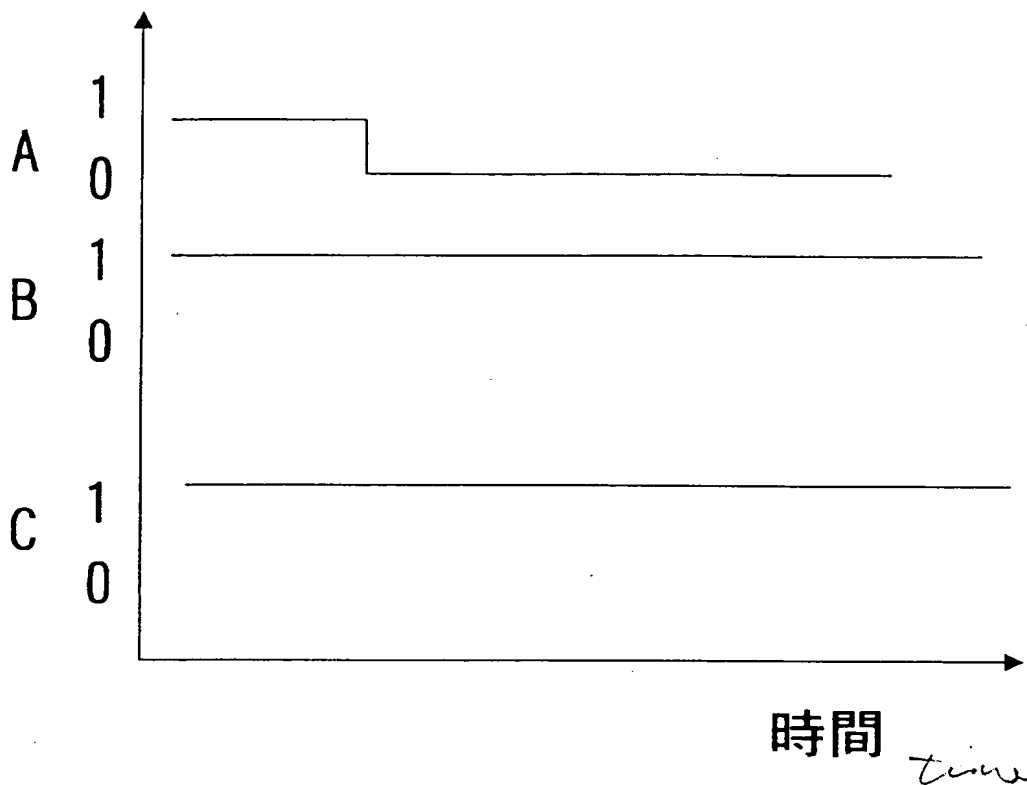
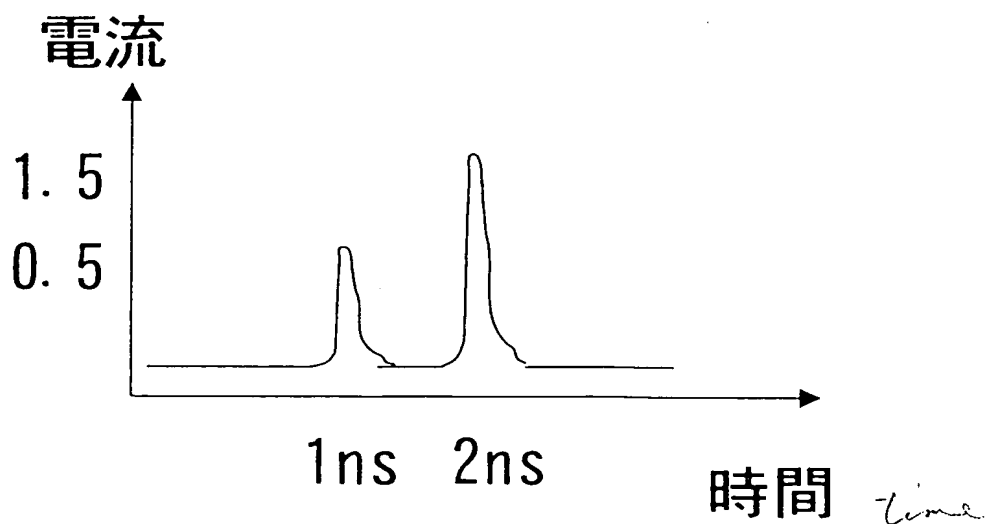


Fig. 70 *current*



007070" 2852T960

The graph shows a current of 1.5 units at a time of 2ns. The vertical axis is labeled 'current' and '電流' (Electric Current) with values 0.5 and 1.5. The horizontal axis is labeled '時間' (Time) and 'time' with values 1ns and 2ns. A vertical line is drawn at 2ns, reaching a current value of 1.5.

The block diagram illustrates the internal structure of the total current calculation unit 9000. It features three input memory units at the top: 9003 (Element Current Memory Unit), 9002 (Signal Change Pattern Memory Unit), and 9001 (Circuit Connection Information Memory Unit). Arrows from 9003 and 9001 converge at a central processing block labeled 9005 (Total Current Calculation Unit). An arrow from 9002 also points to this block. The output of the calculation unit 9005 is directed to a final memory unit at the bottom, 9004 (Total Current Memory Unit).

Fig. 73

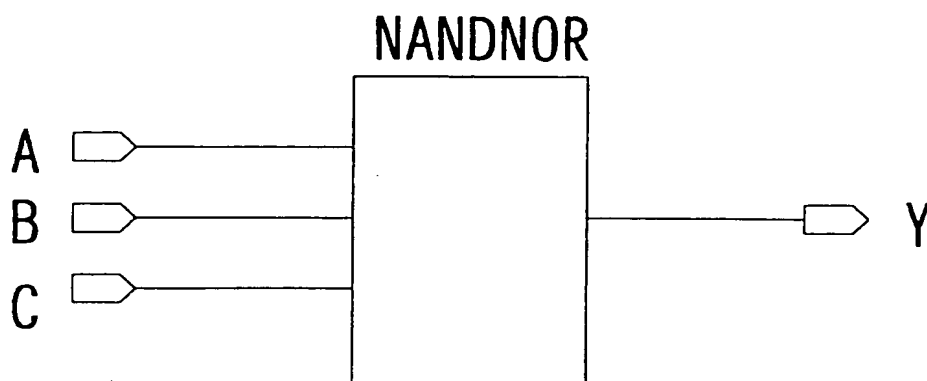
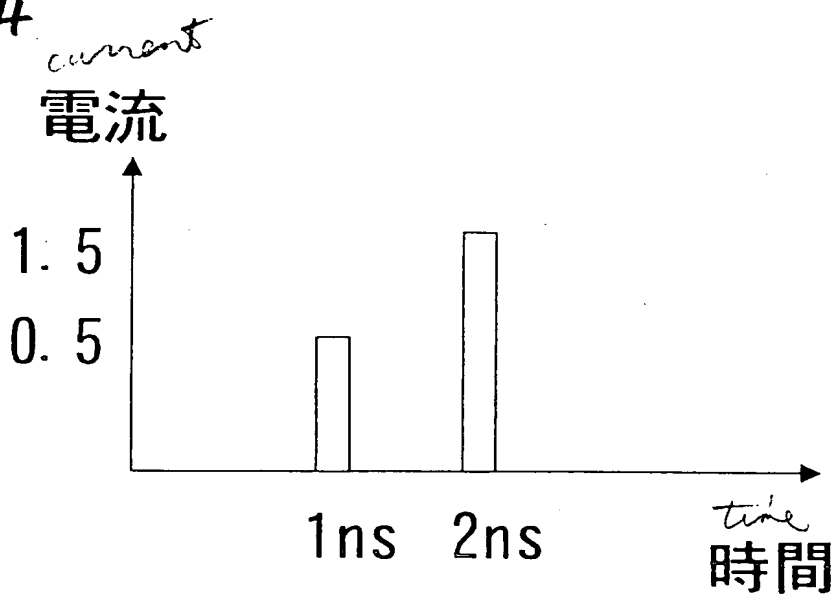


Fig. 74



00612582,070700

Fig. 75

## NANDNOR

変化ピン	時間	電流総量	ピーク
A	1ns	1mA	0.5mA
A	2ns	3mA	1.5mA
B	1ns	1mA	0.5mA
B	2ns	3mA	1.5mA
C	1ns	3mA	1.5mA

090200Z JUL 70

Fig. 76

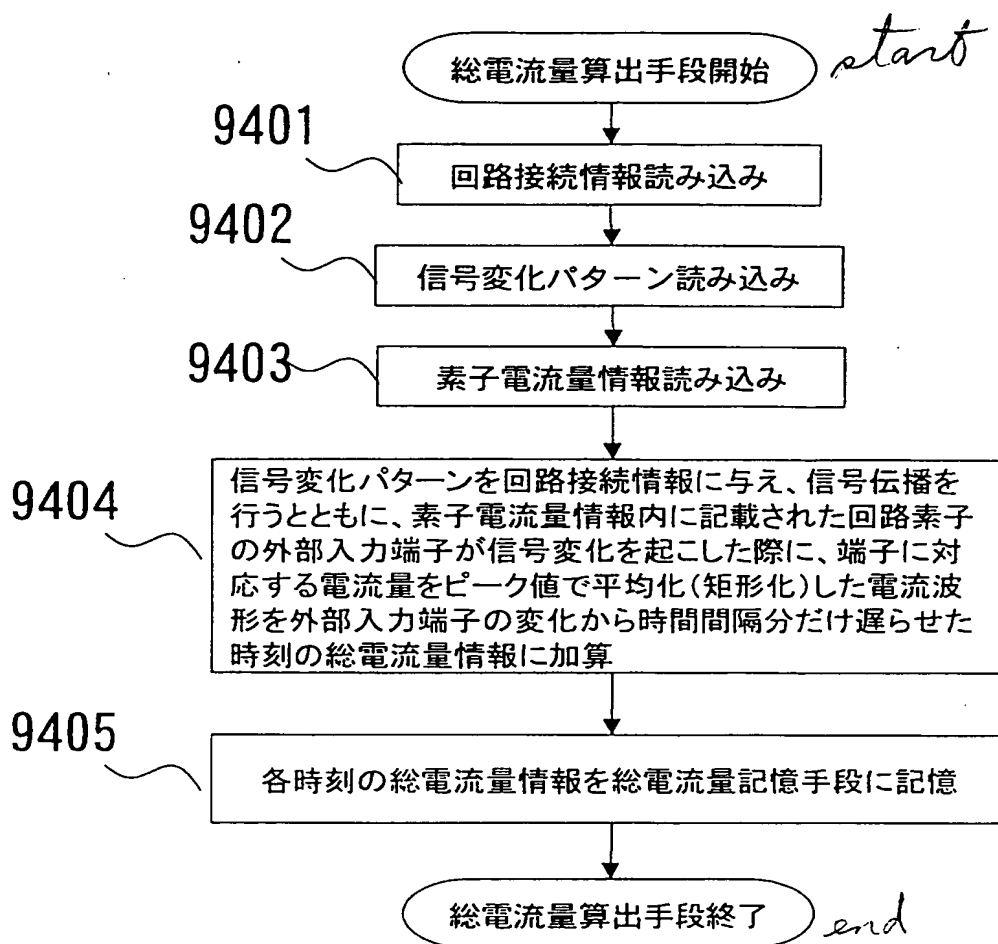


Fig. 77

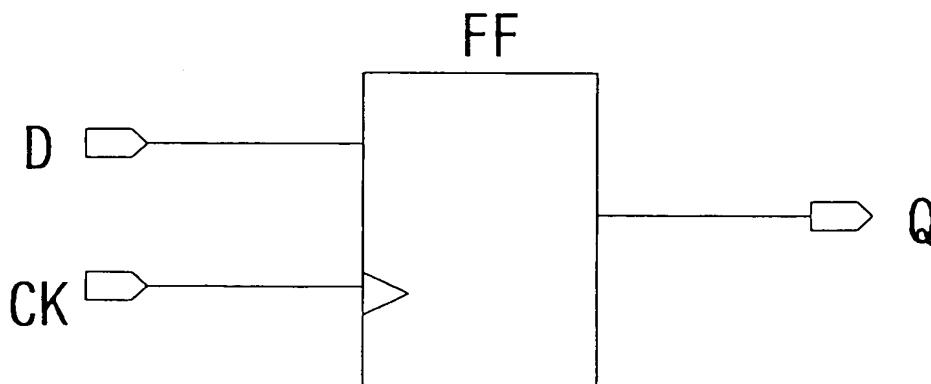
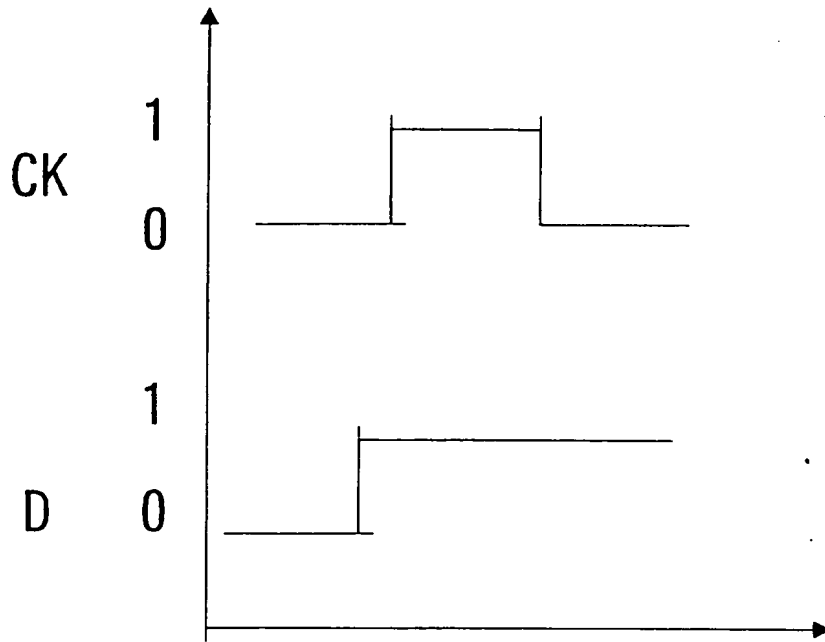




Fig. 78

*logic*  
論理

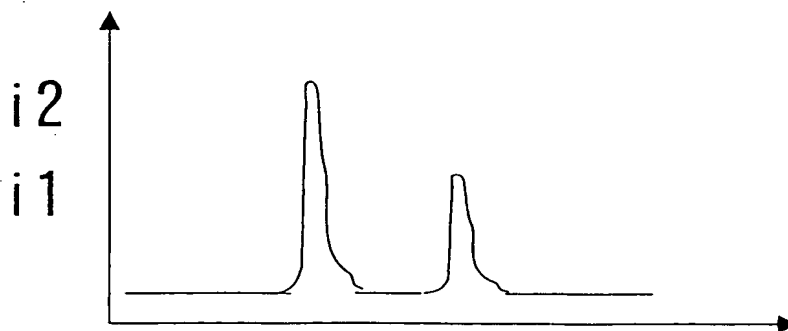


時間  
*time*

Fig. 79

*current*

電流



時間  
*time*

004020"28521960

Fig. 80.

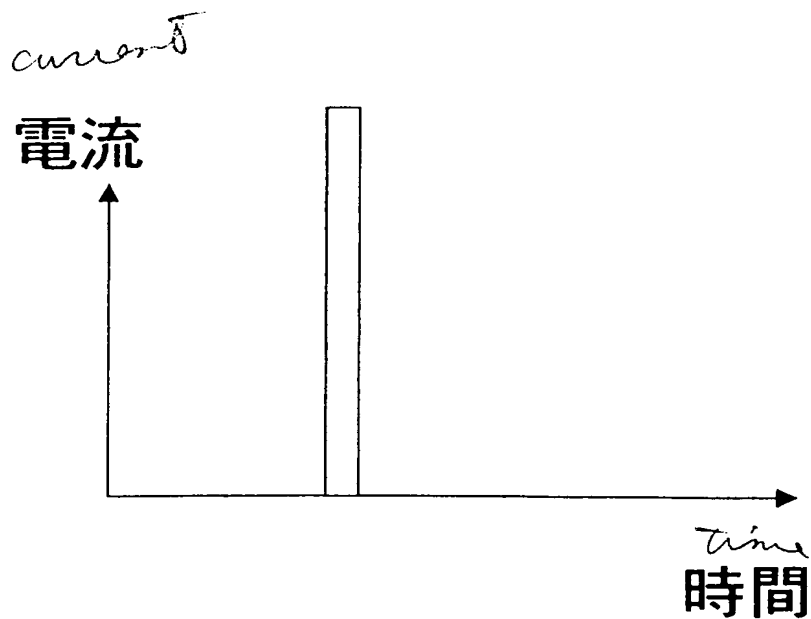


Fig. 81

FF

*edge*  
 エッジ  
 rise  
 fall

*current*  
 電流

*peak value*  
 ピーク値

15mA  
 5mA

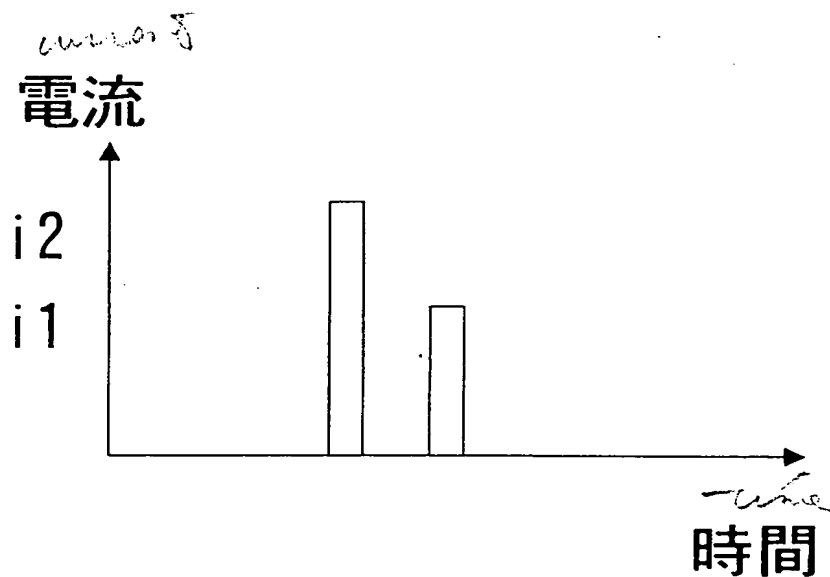
7.5mA  
 2.5mA

9901

9902

09512582-070700

Fig. 82



09612582-070700

Fig. 83

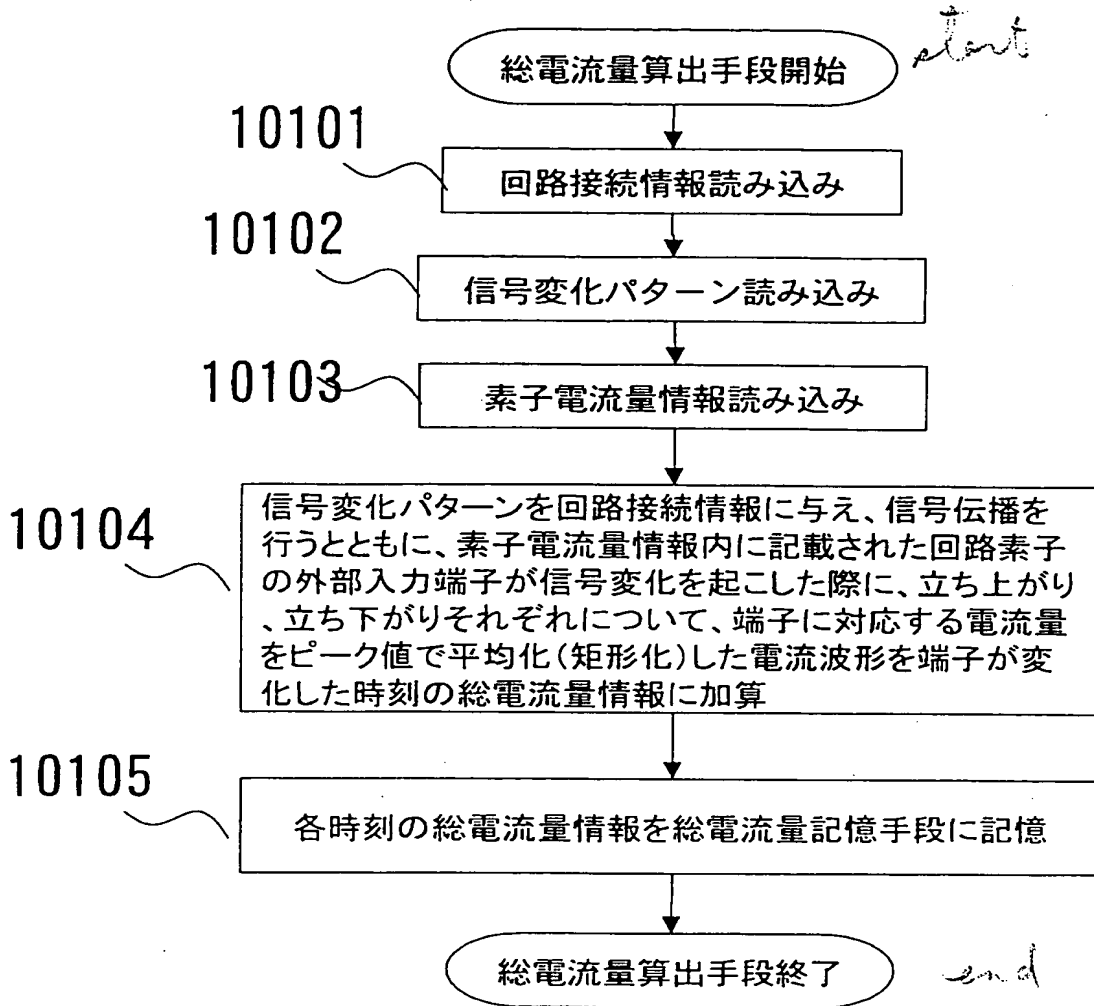


Fig. 84

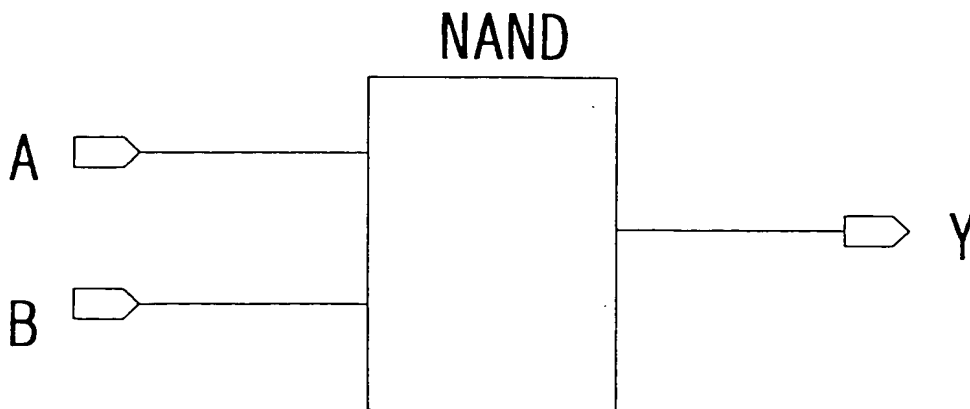


Fig. 85

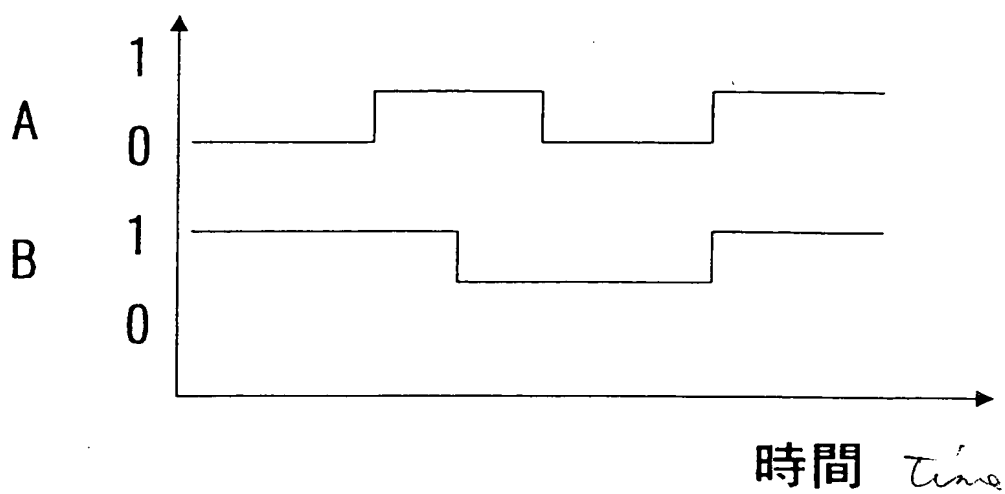
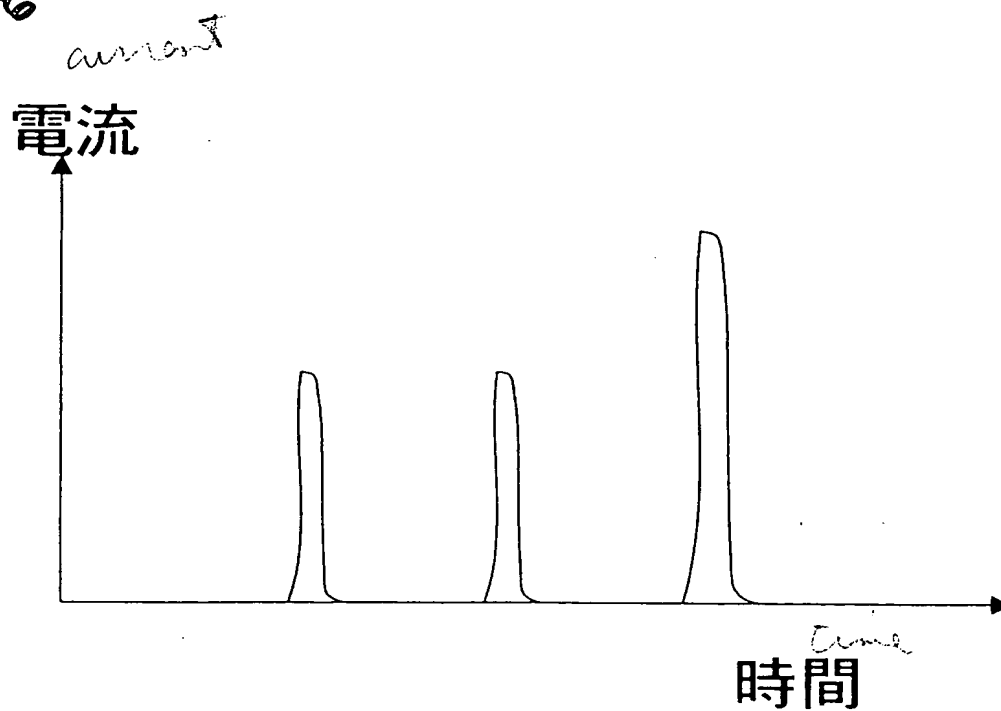


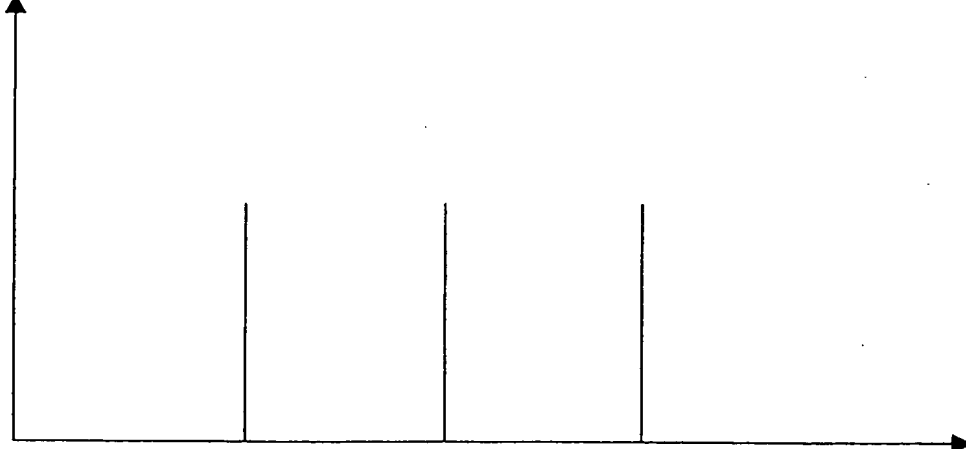
Fig. 86



00612582-070700

Fig. 87

電流



時間 Time

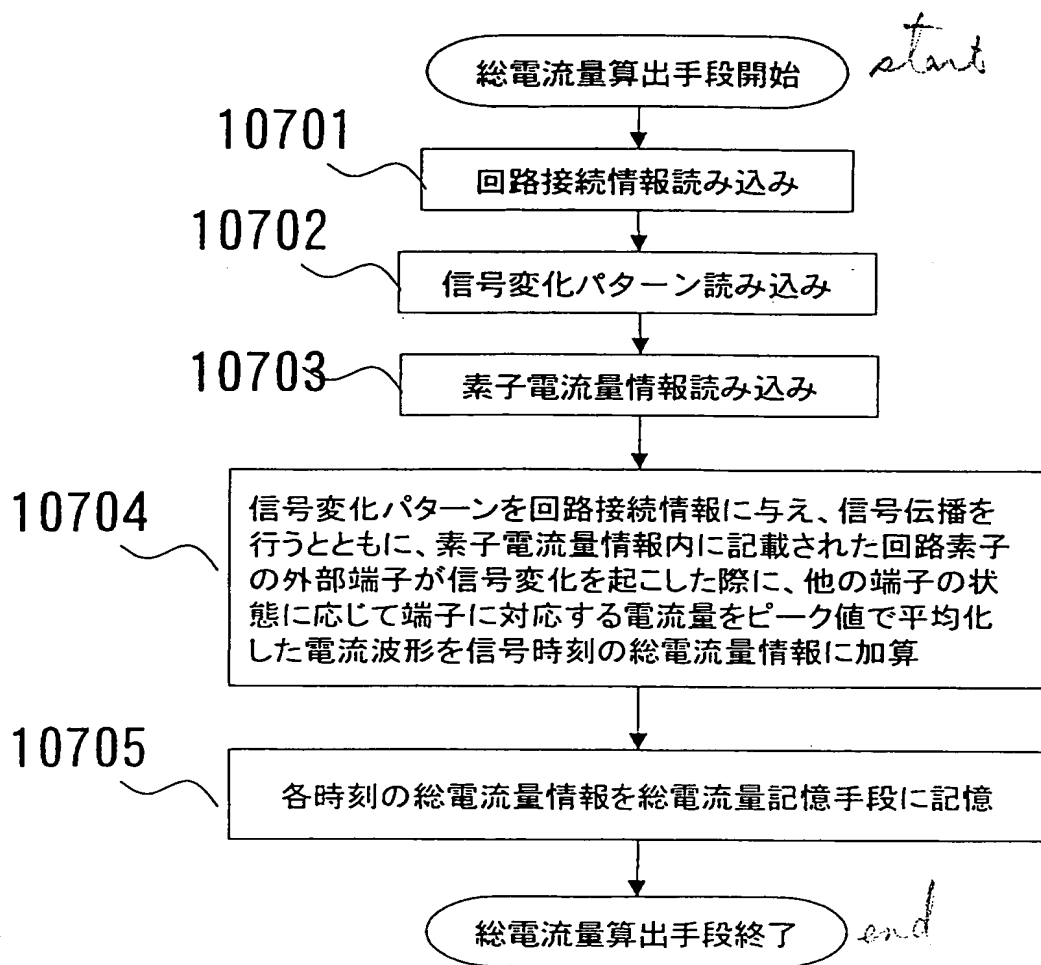
論理和否定 NAND Y端子

Terminal

10601

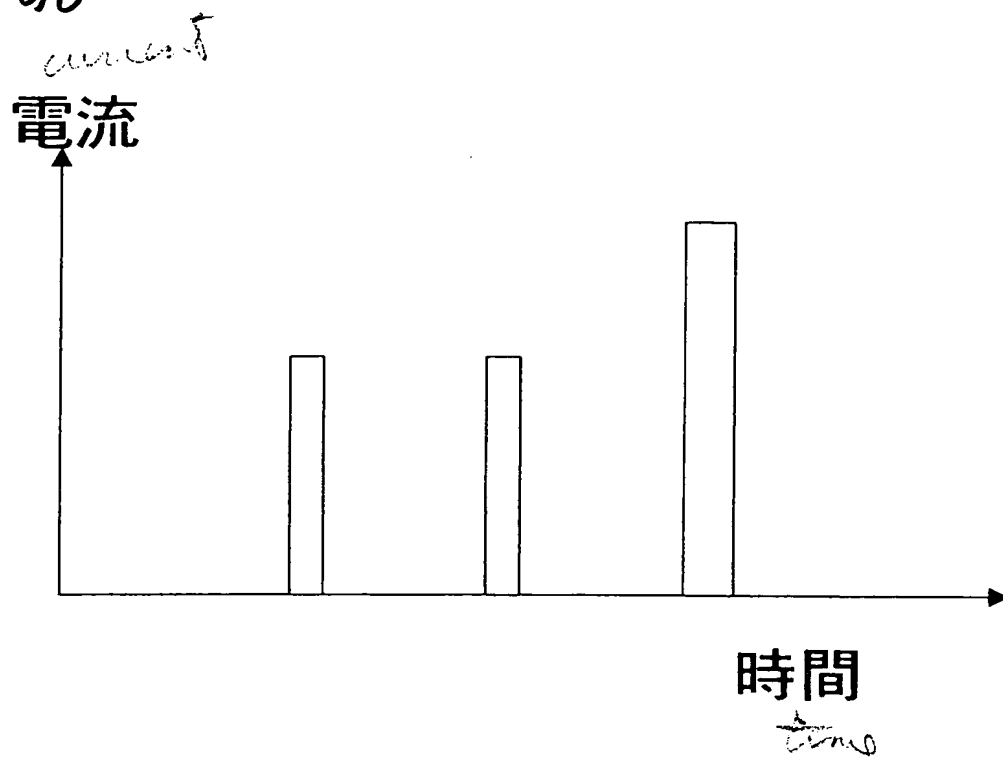
A=1, B=0→1時の電流総量	Total	3mA
A=1, B=0→1時のピーク値	peak	1mA
A=1, B=1→0時の電流総量	Total	3mA
A=1, B=1→0時のピーク値	peak	1mA
B=1, A=0→1時の電流総量	Total	3mA
B=1, A=0→1時のピーク値	peak	1mA
B=1, A=1→0時の電流総量	Total	3mA
B=1, A=1→0時のピーク値	peak	1mA
A=0→1, B=0→1時の電流総量	Total	4mA
A=0→1, B=0→1時のピーク値	peak	1.5mA
A=1→0, B=1→0時の電流総量	Total	4mA
A=1→0, B=1→0時のピーク値	peak	1.5mA

Fig 89



00612582.070700

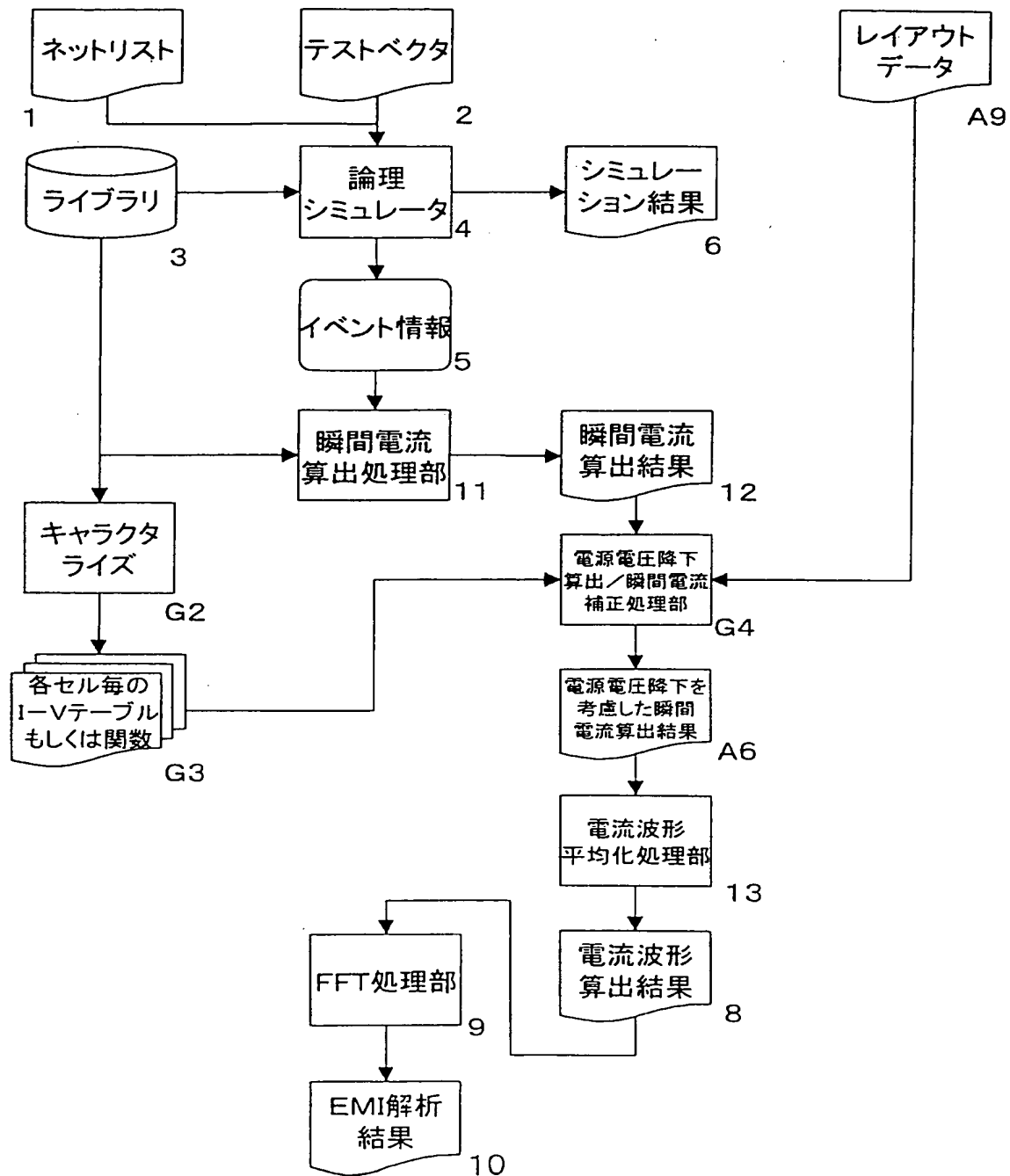
Fig. 90



09612582-070700

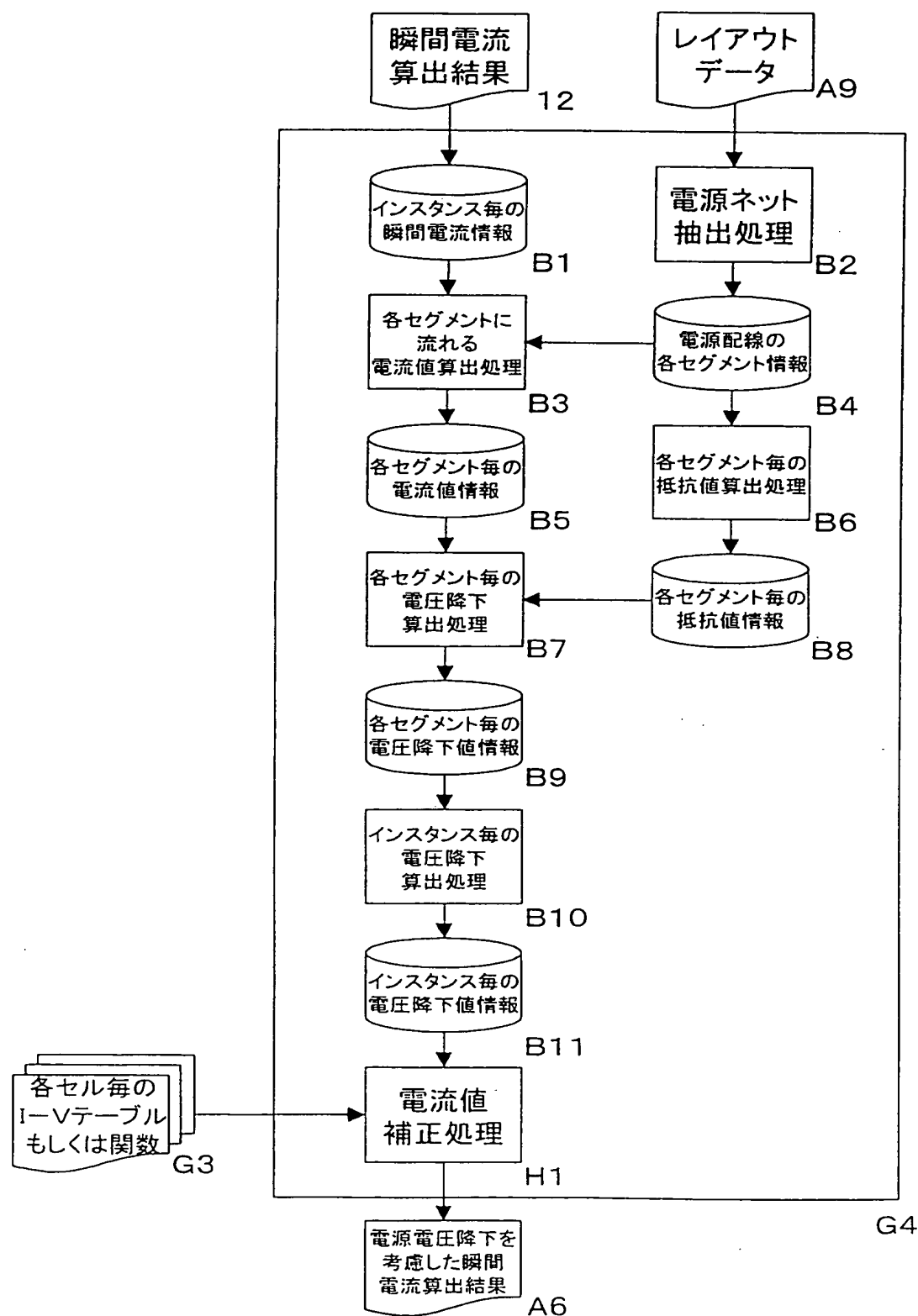


Fig. 91



09612582-070700

Fig. 92



004040"28527960

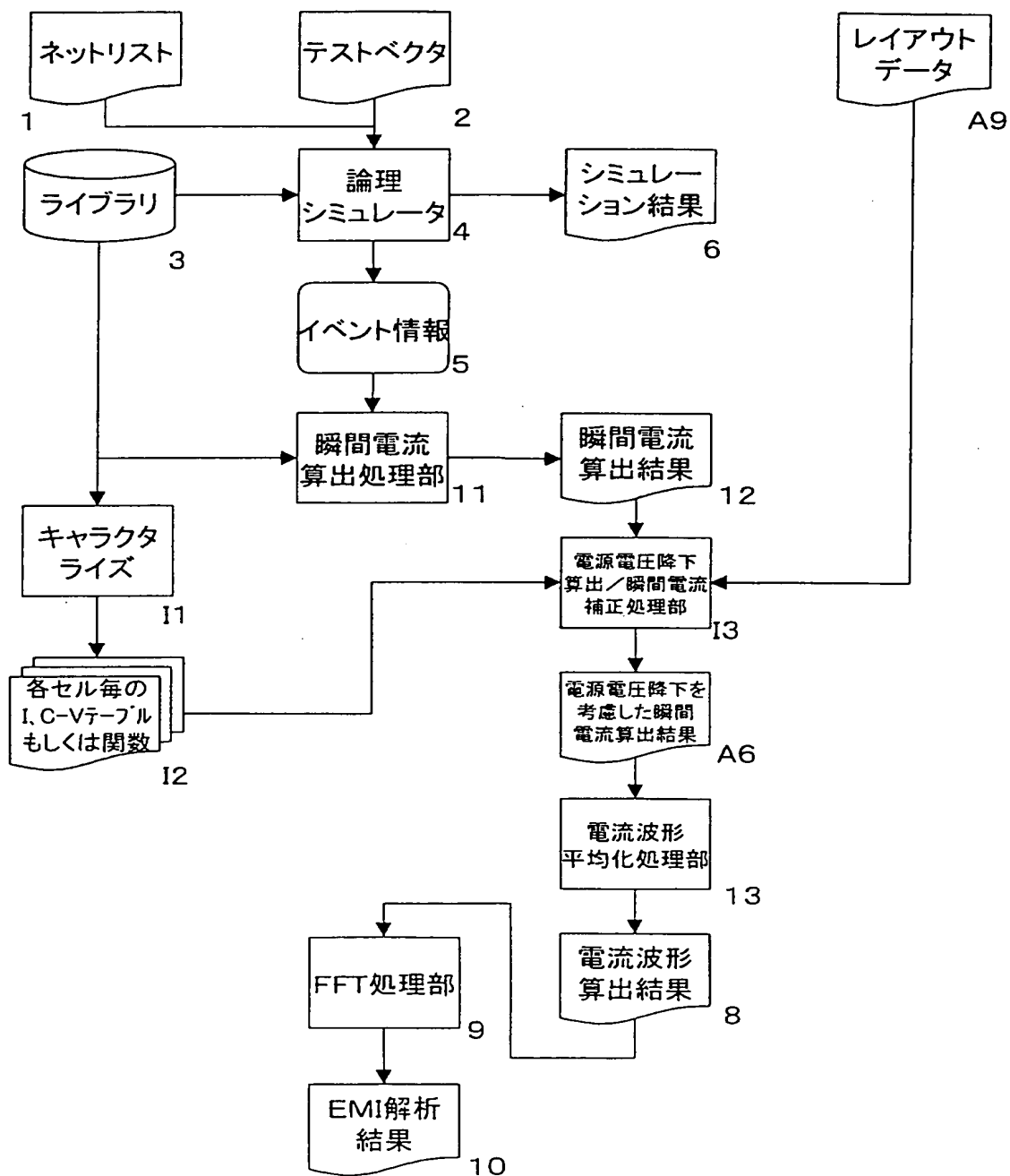
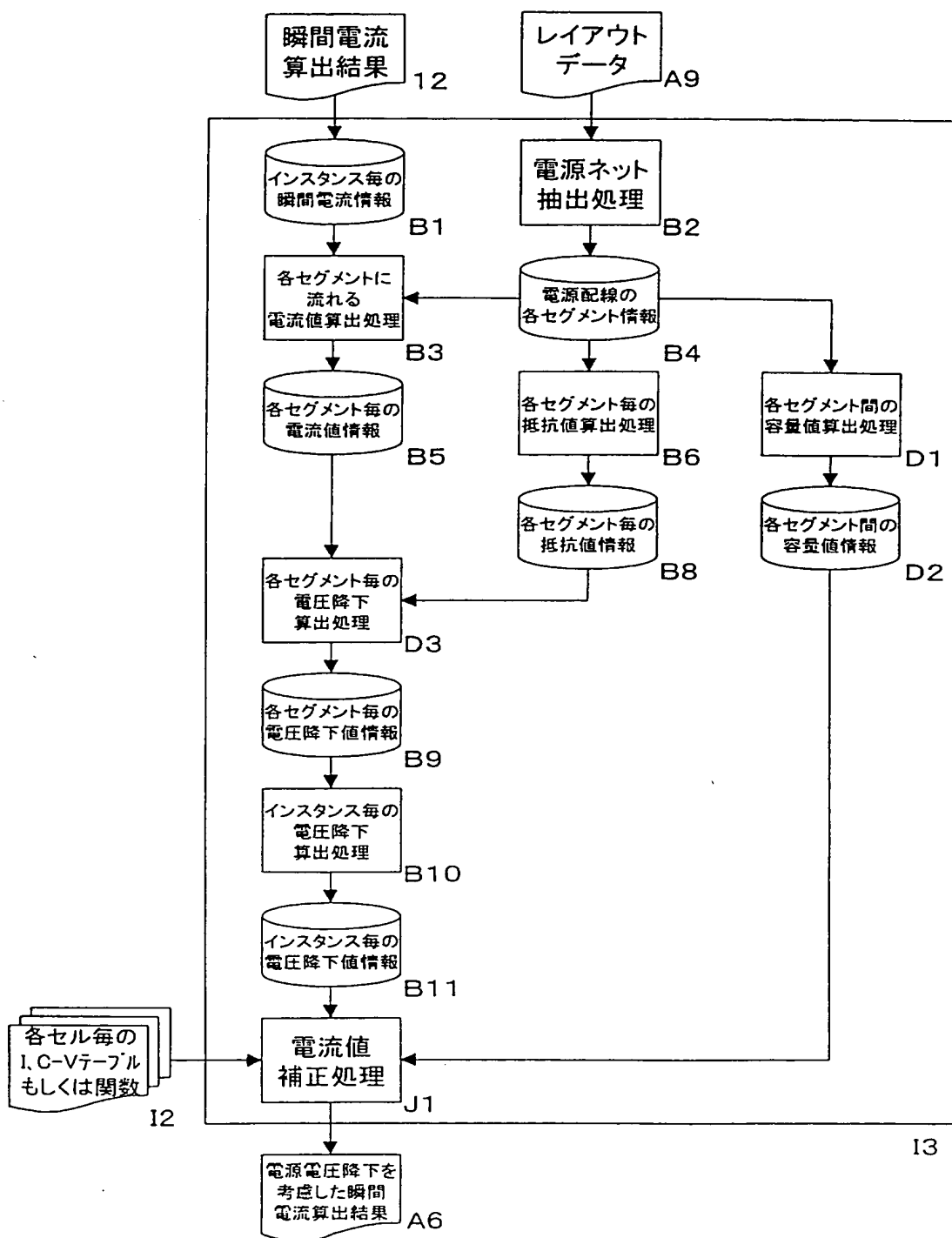
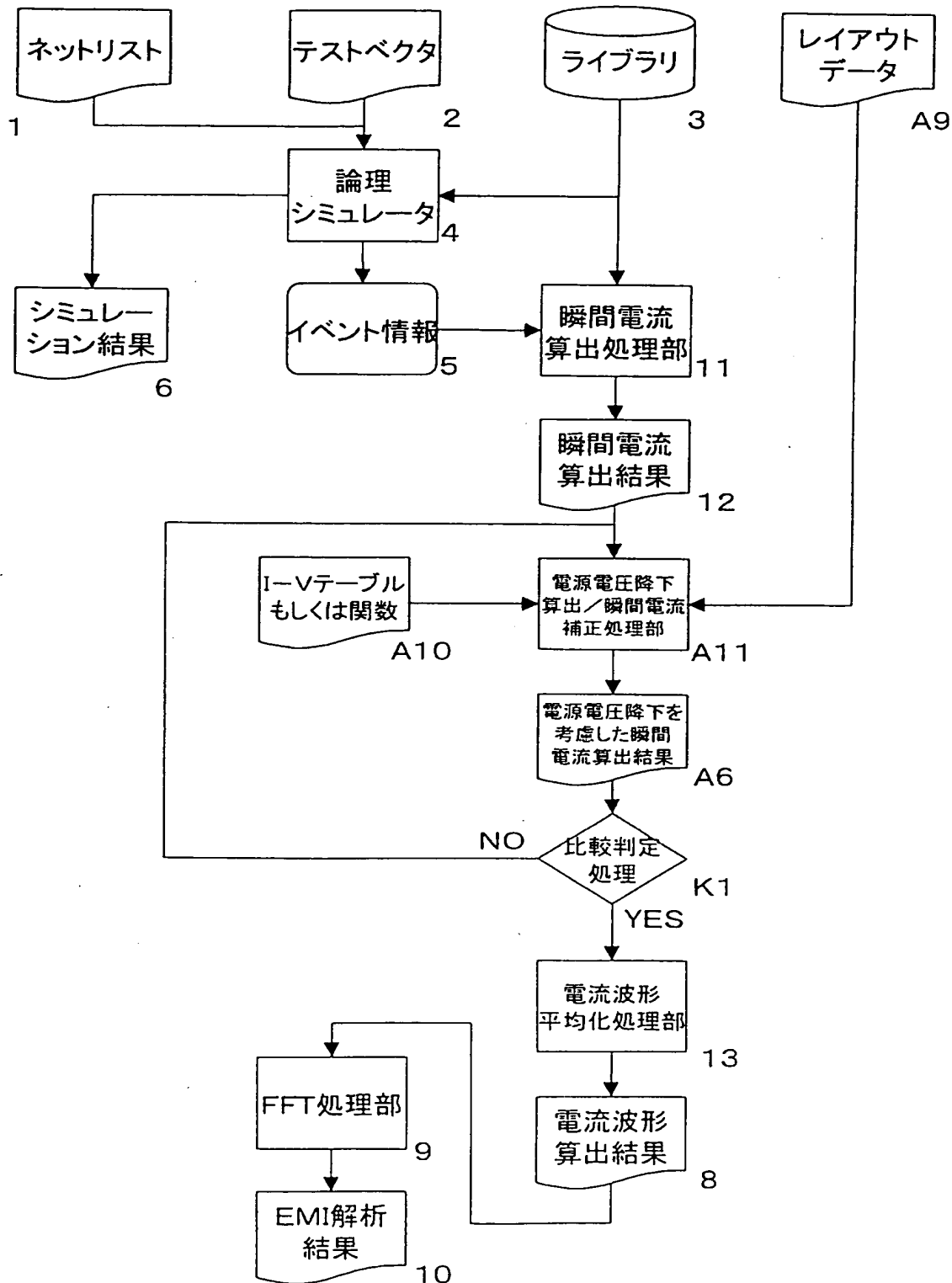
[illegible]

Fig. 94



09612582-070700

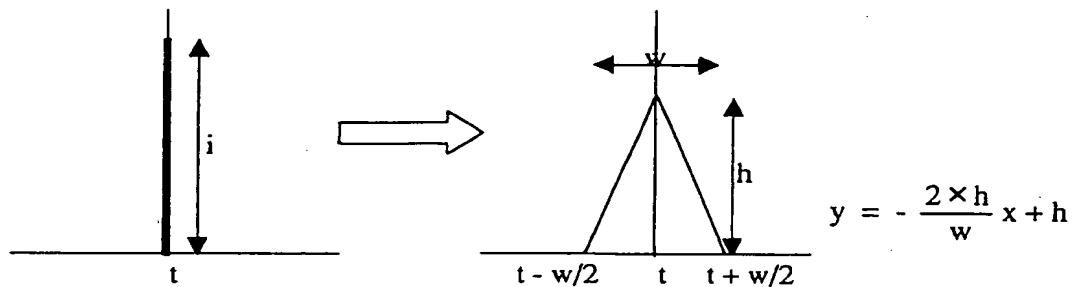
Fig. 95



09612582-070700

Fig. 96

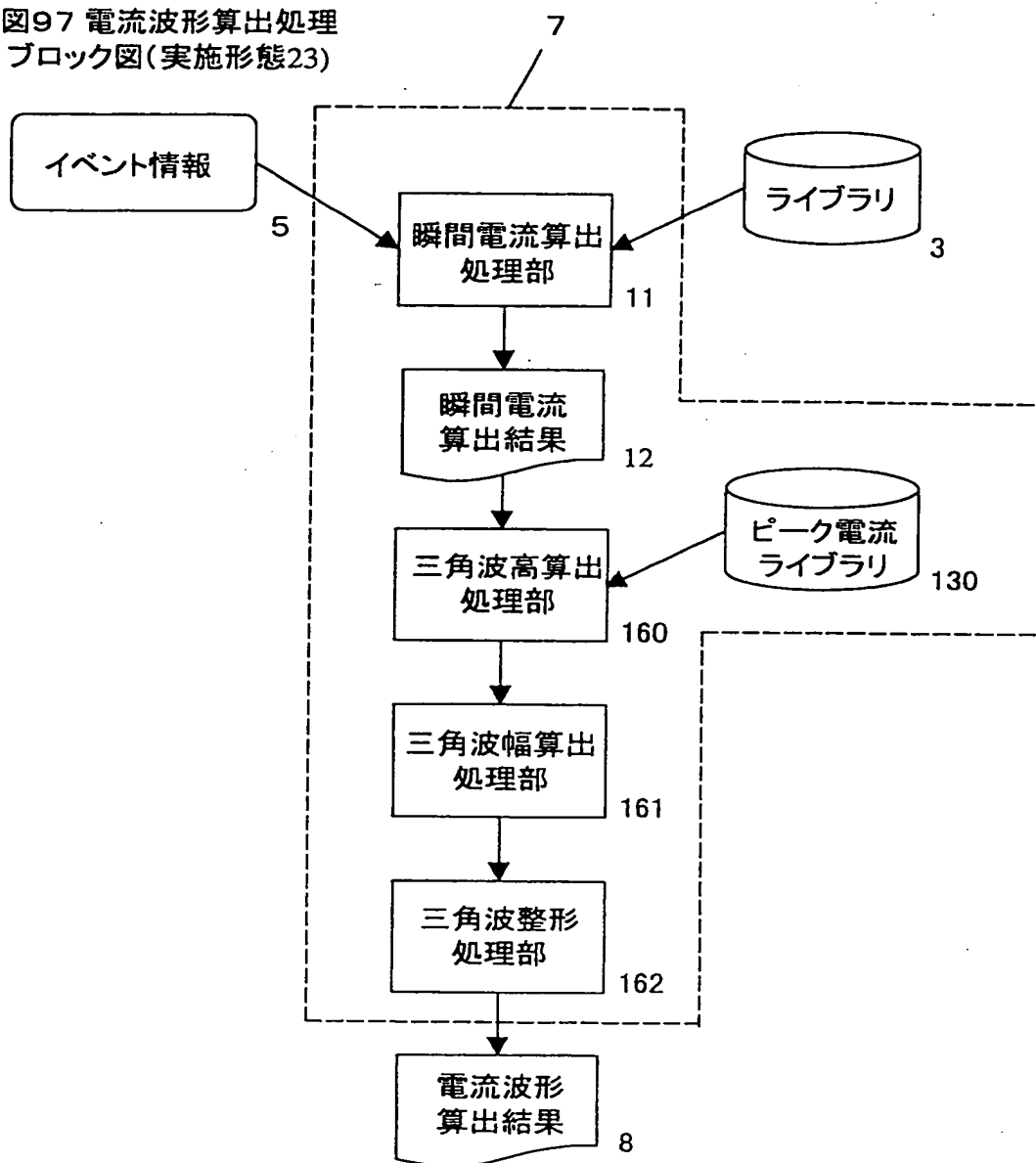
図96 三角波モデル(実施形態23)



004040"2852T960

Fig. 97

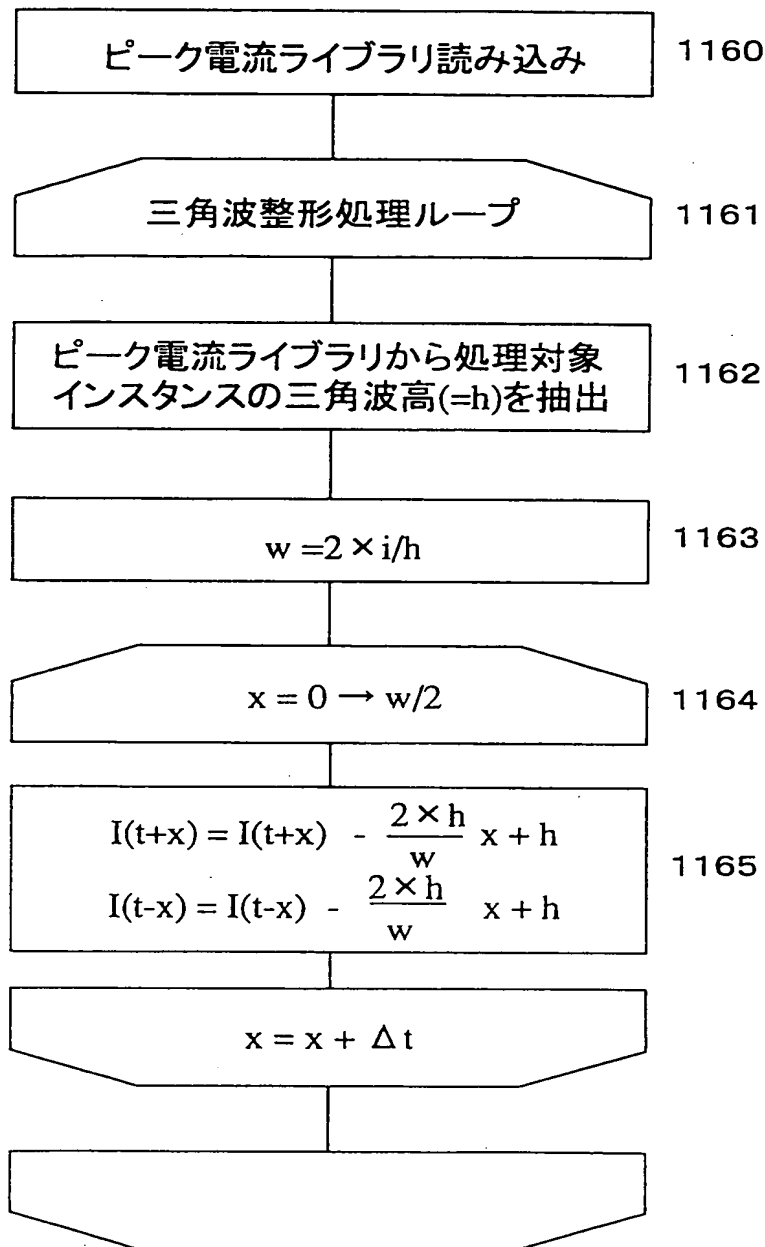
図97 電流波形算出処理  
 ブロック図(実施形態23)



09612582-070700

Fig. 98

図98 三角波整形処理フロー図

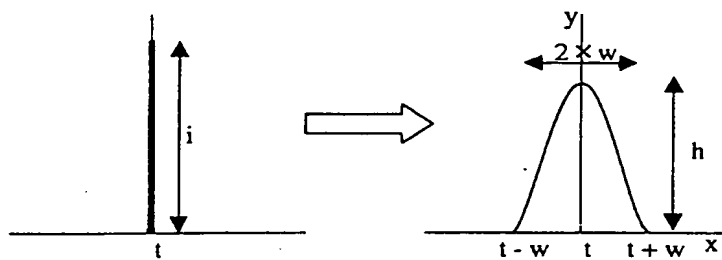


004040"28521960



Fig. 99

図99 複数次関数モデル(実施形態24)



$$y = a(x - w)^2(x + w)^2$$

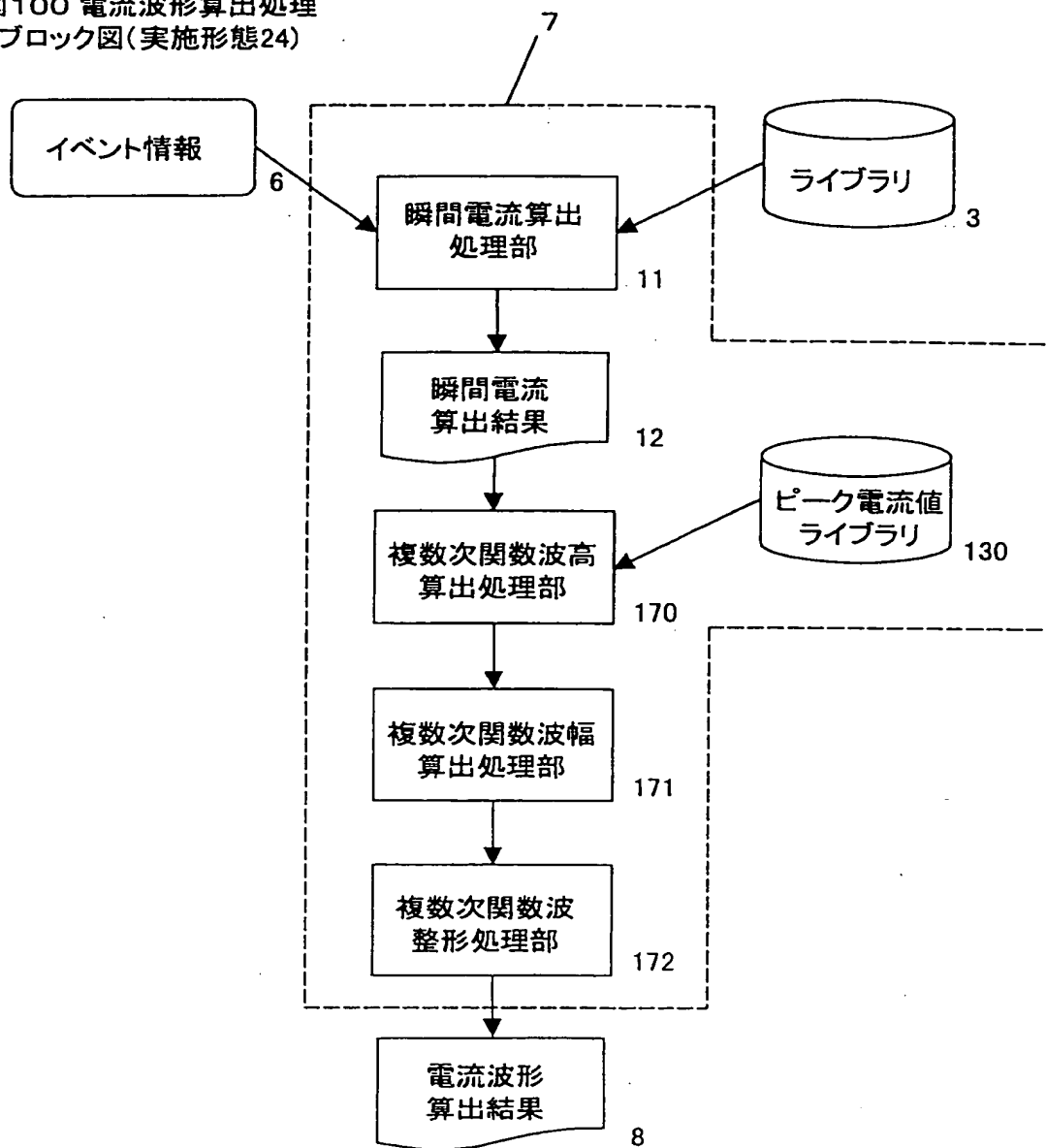
$$w = \frac{15 \times i}{16 \times h}$$

$$a = \frac{15}{16 \times w^5} i$$

004040" 2852T960

Fig. 100

図100 電流波形算出処理  
ブロック図(実施形態24)



004040"28521960

Fig.101

図101 複数関数整形処理フロー図

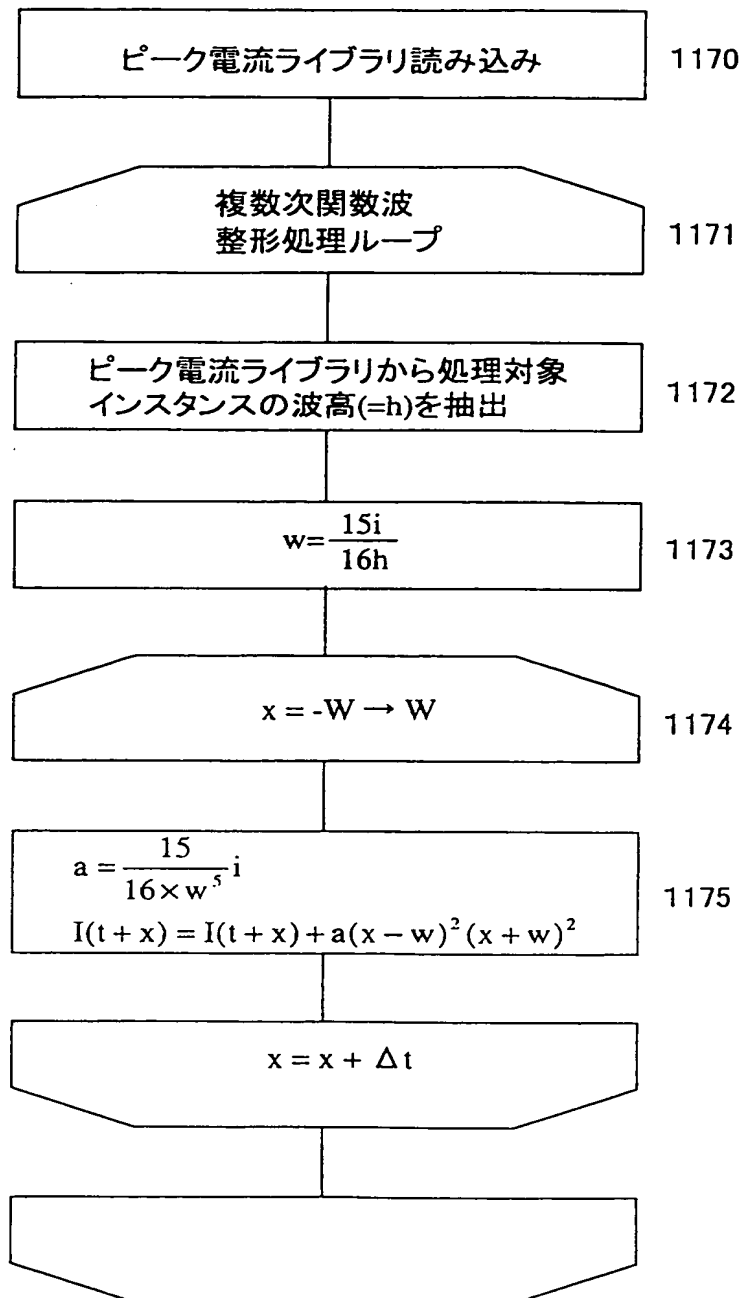
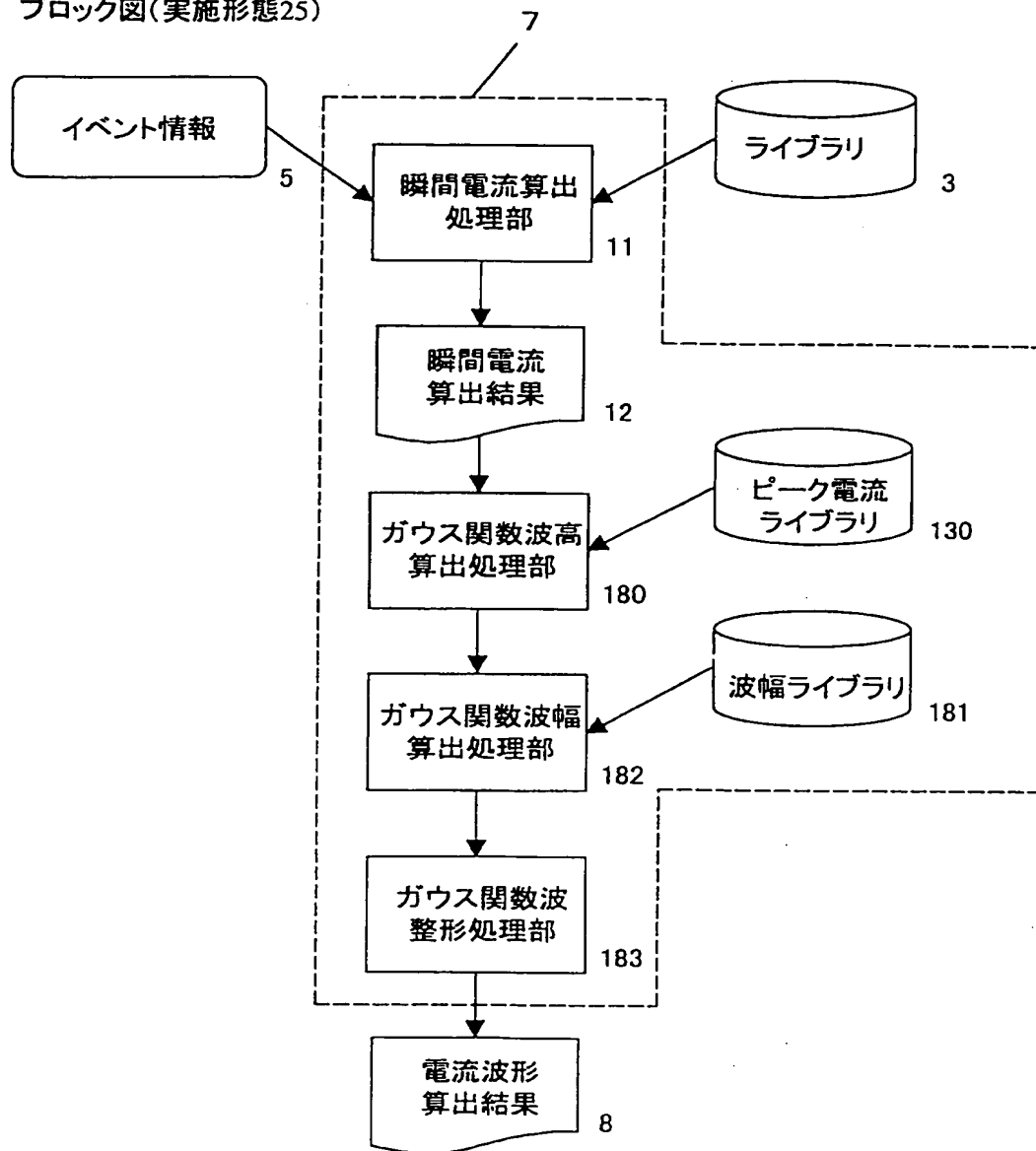


Fig. 102

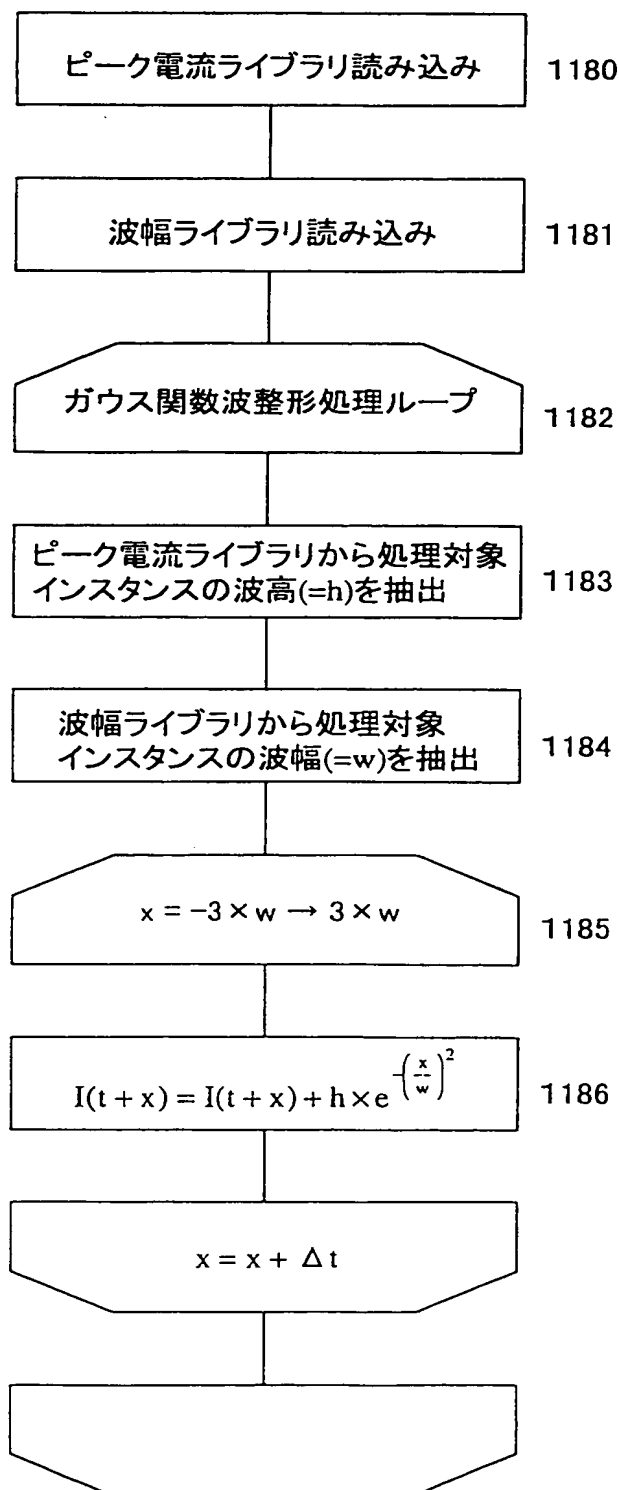
図102 電流波形算出処理  
ブロック図(実施形態25)



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Fig. 103

図103 ガウス関数波整形処理フロー図



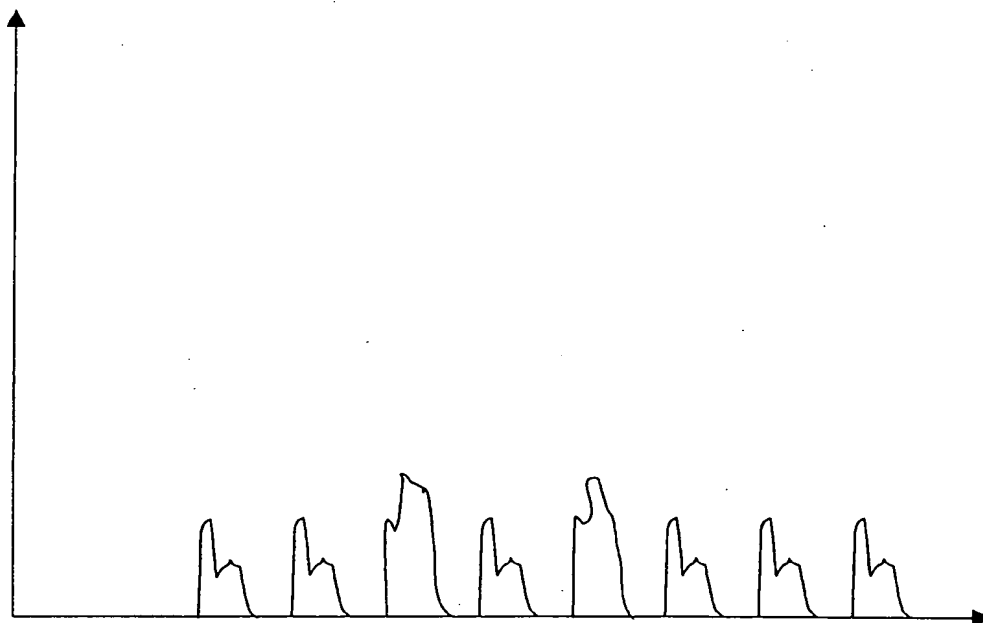
004020"2852T960

Fig.104

*current*

電流

3  
2  
1



時間  
*Time*

002020"28521960

Fig.105

## フリップフロップFF/Q

貫通電流総量 *total* 3mA貫通電流ピーク値 *peak* 1mAチャージ電流総量 *total* 4mAチャージ電流ピーク値 *peak* 2mA

## フリップフロップFF/CK

貫通電流総量 *total* 2mA貫通電流ピーク値 *peak* 1mAチャージ電流総量 *total* 0mAチャージ電流ピーク値 *peak* 0mA

## バッファBUF/Y

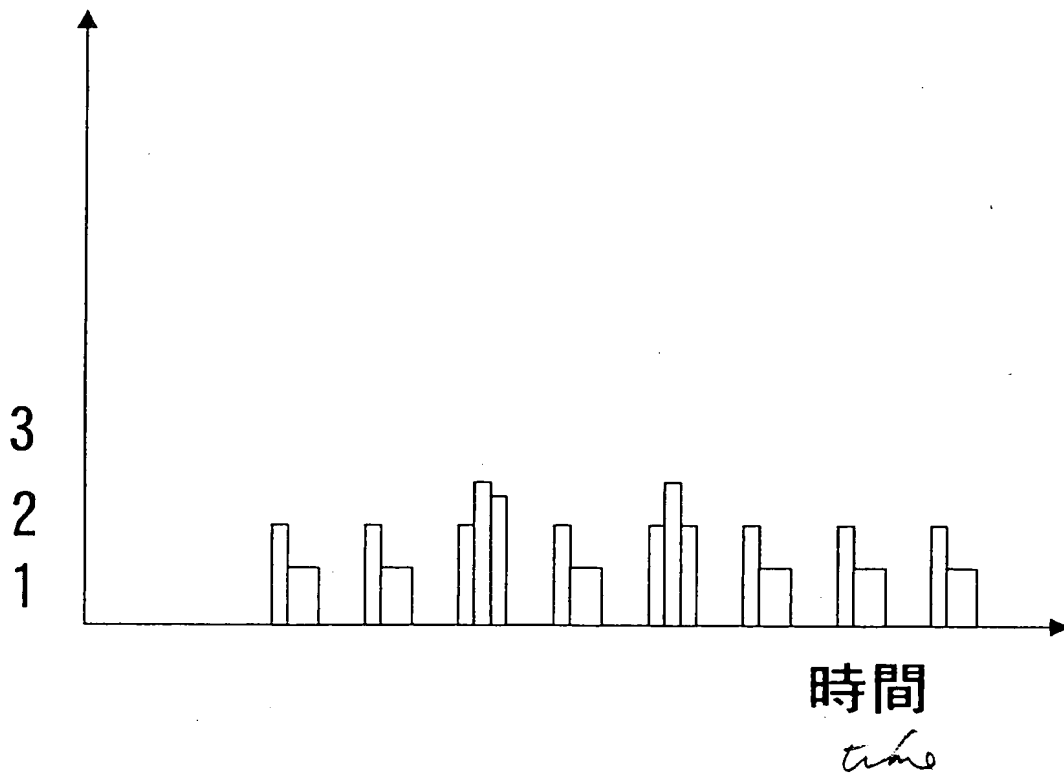
貫通電流総量 *total* 2mA貫通電流ピーク値 *peak* 1mAチャージ電流総量 *total* 0mAチャージ電流ピーク値 *peak* 0mA

004040"28527960

Fig. 106

*current*

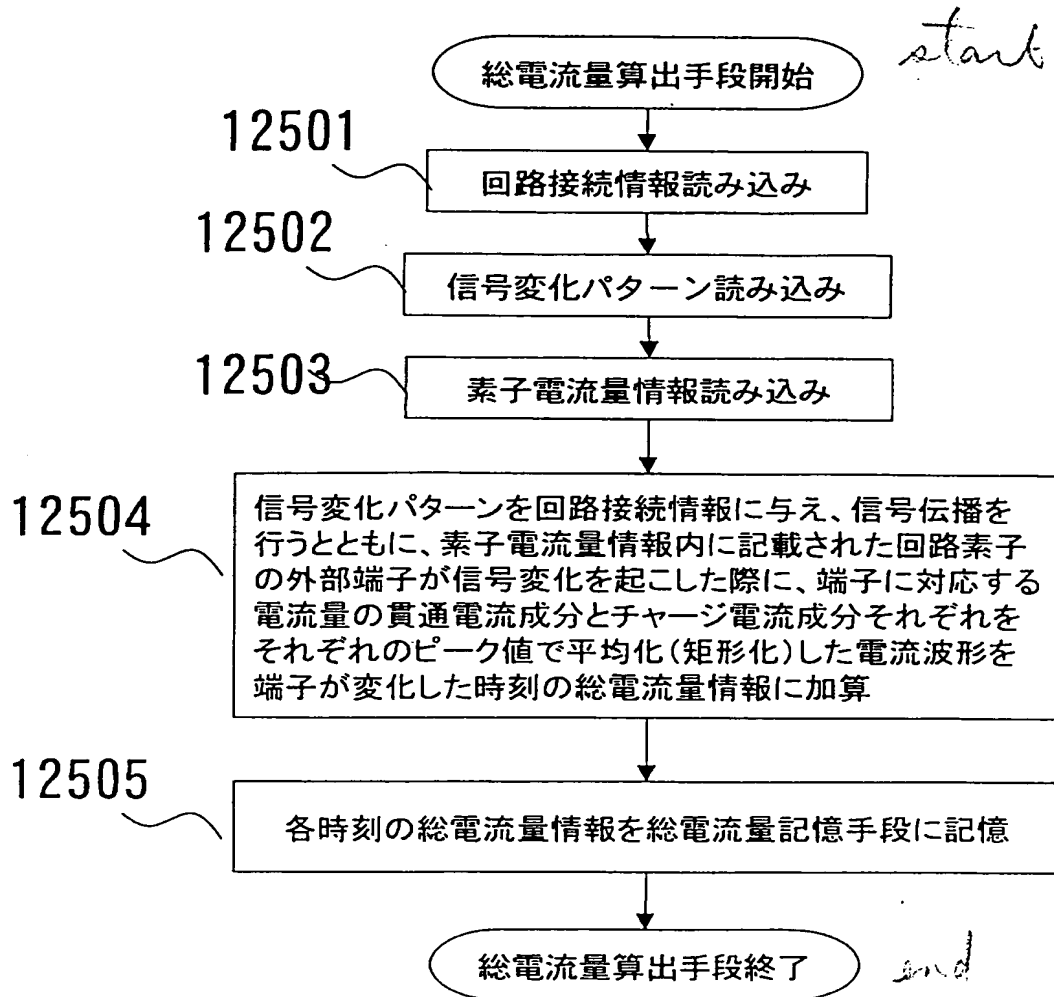
電流



002020"2852T960



Fig.107



007070"2852T960

Fig. 108

# NANDNOR

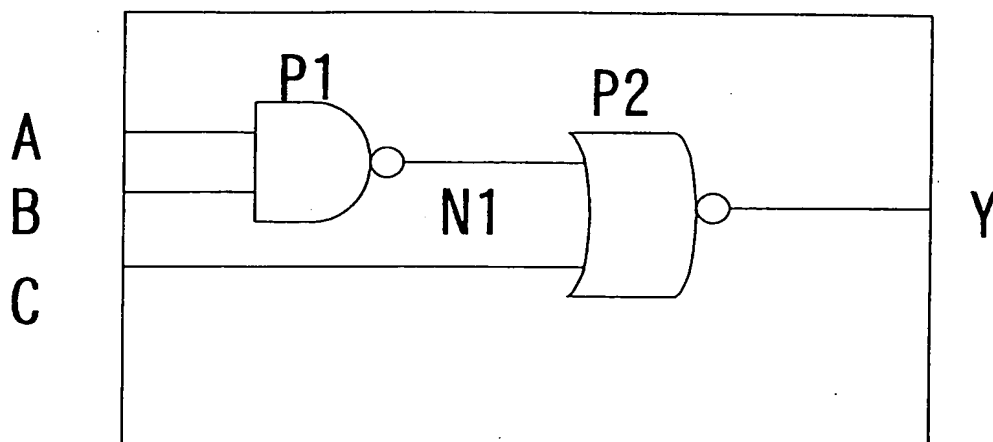


Fig. 109

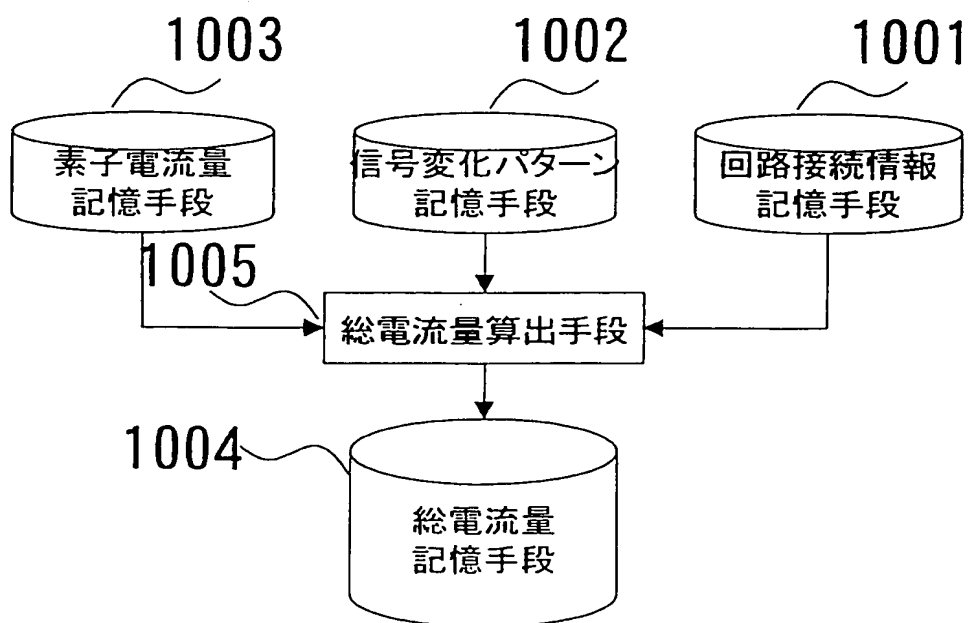


Fig.110

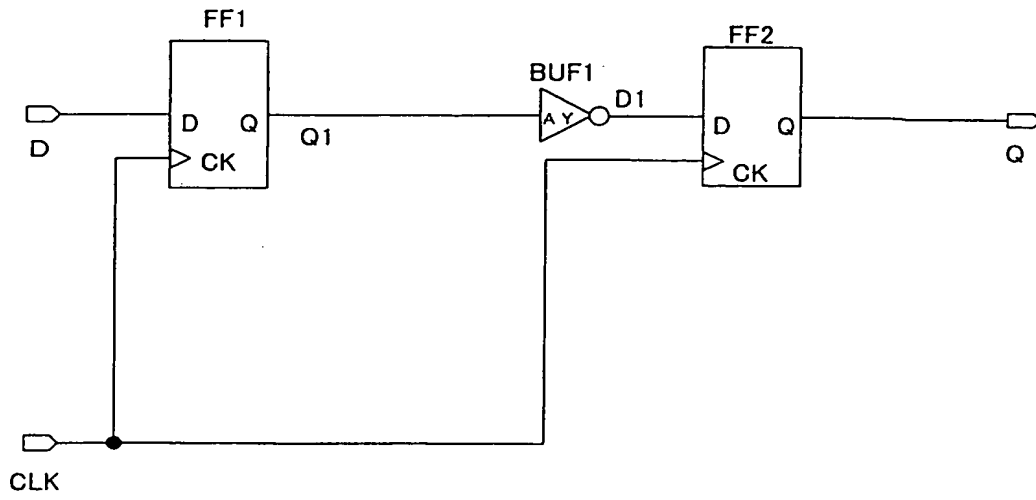
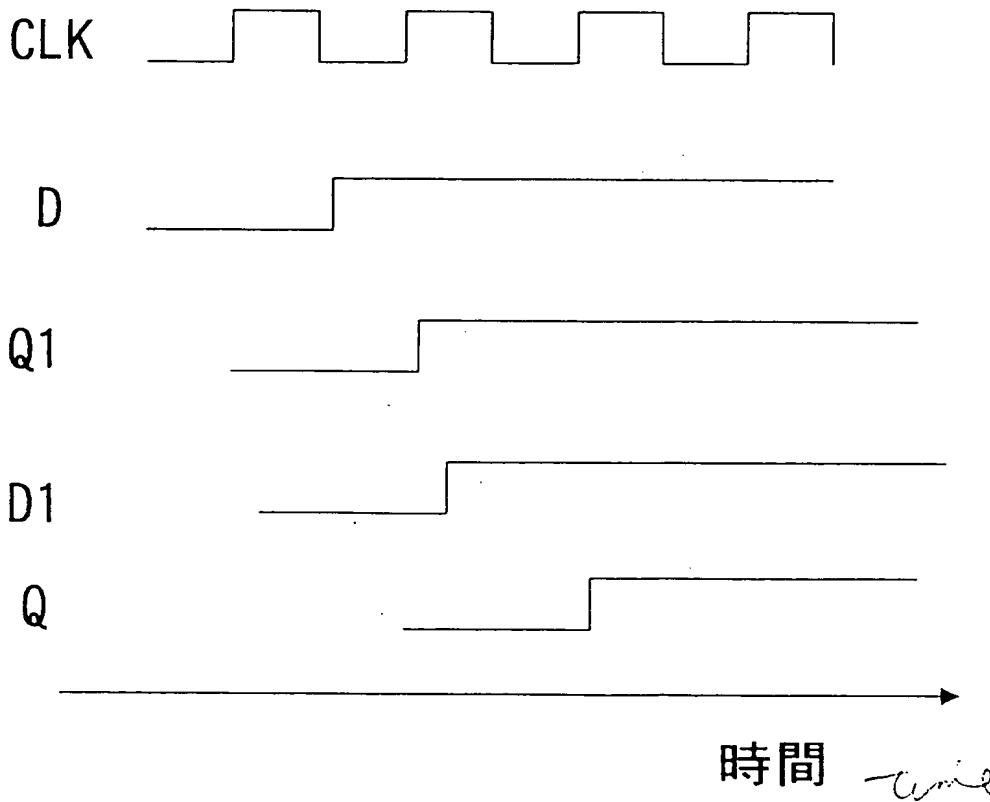


Fig.111

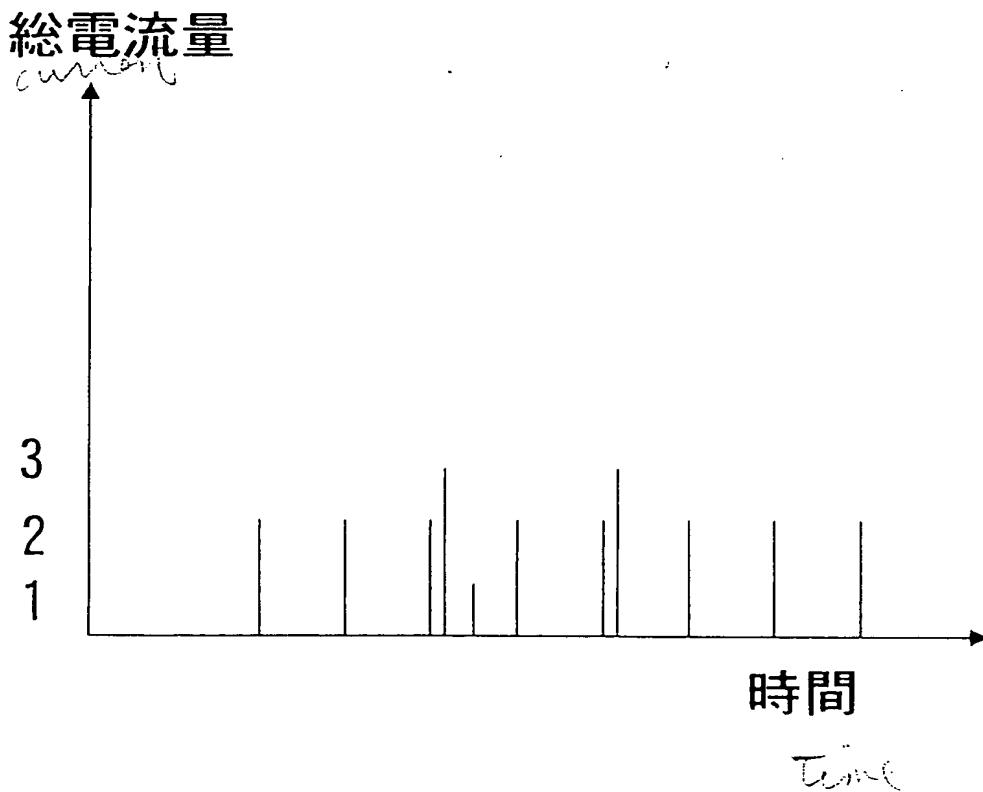


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Fig.112

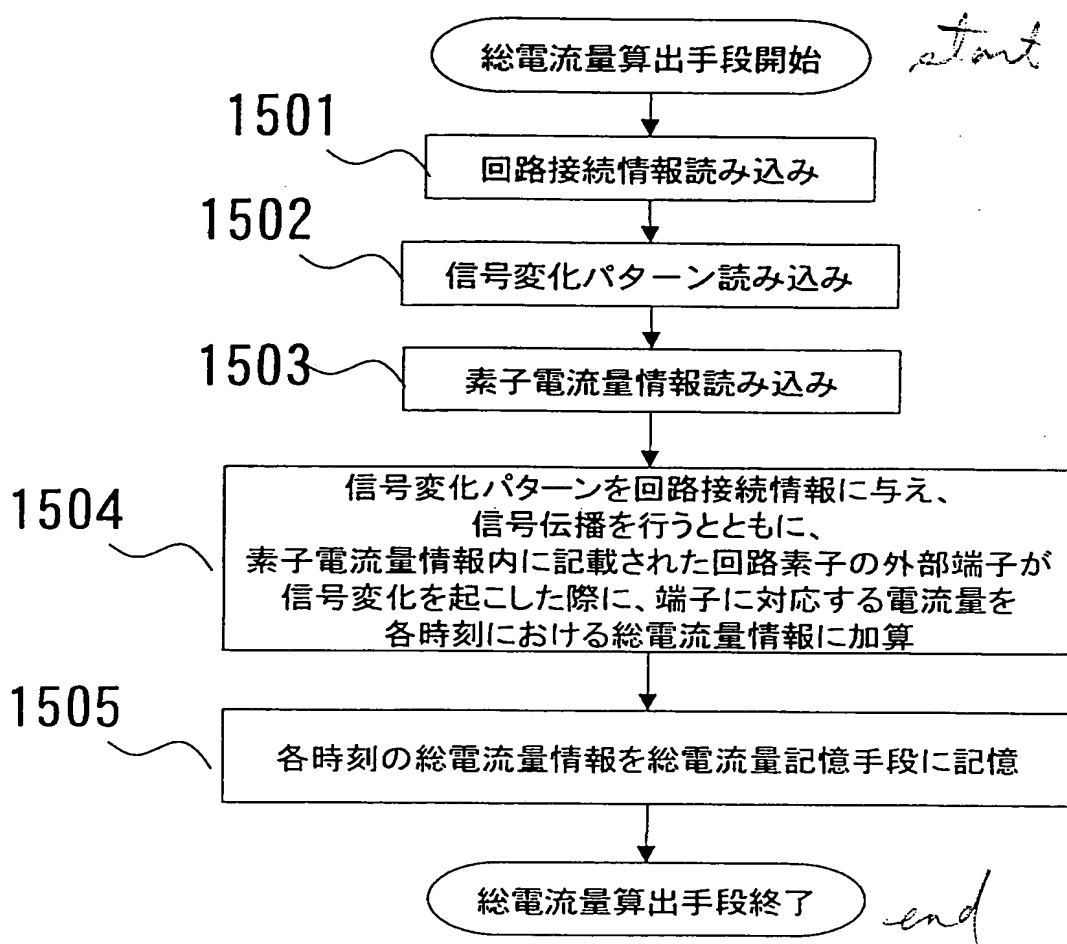
フリップフロップFF	
Y変化時電流量 5mA	1301
CK変化時電流量 2mA	1302
バッファBUF	
Y変化時電流量 1mA	1303

Fig.113



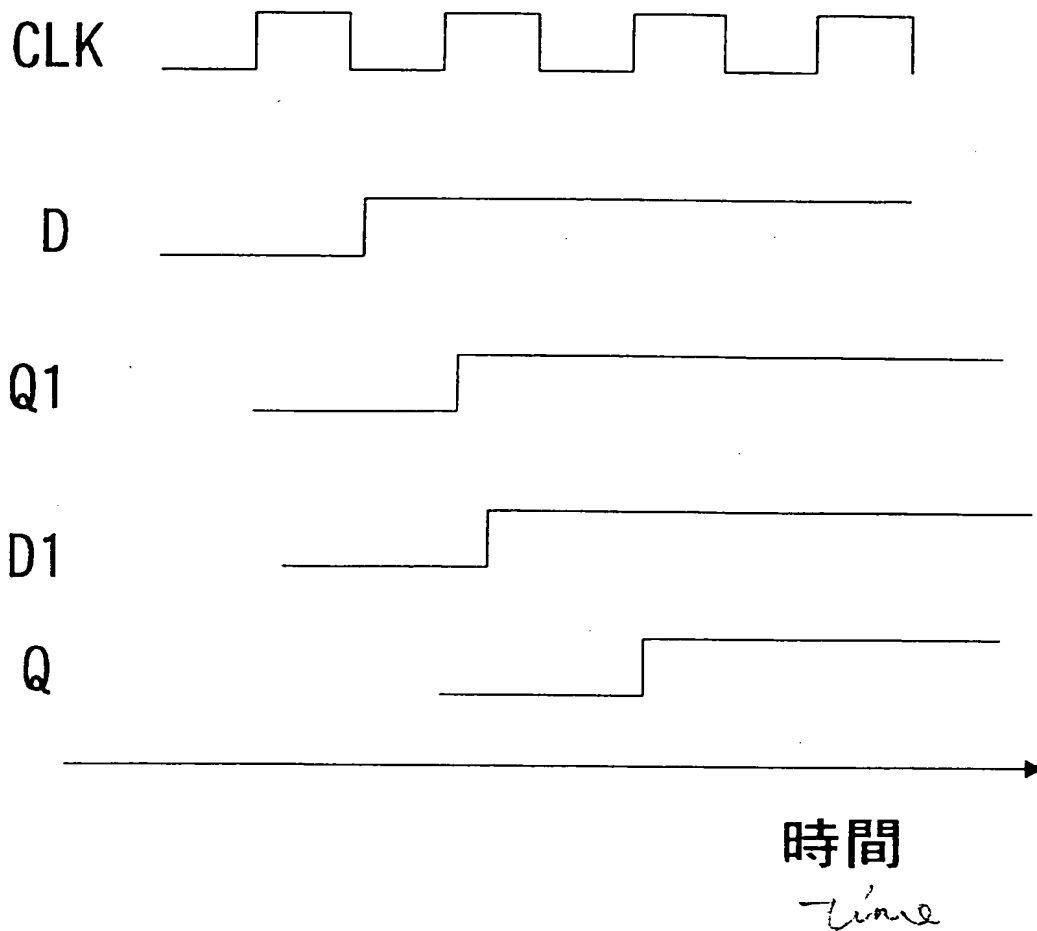
00612582-070700

Fig. 114



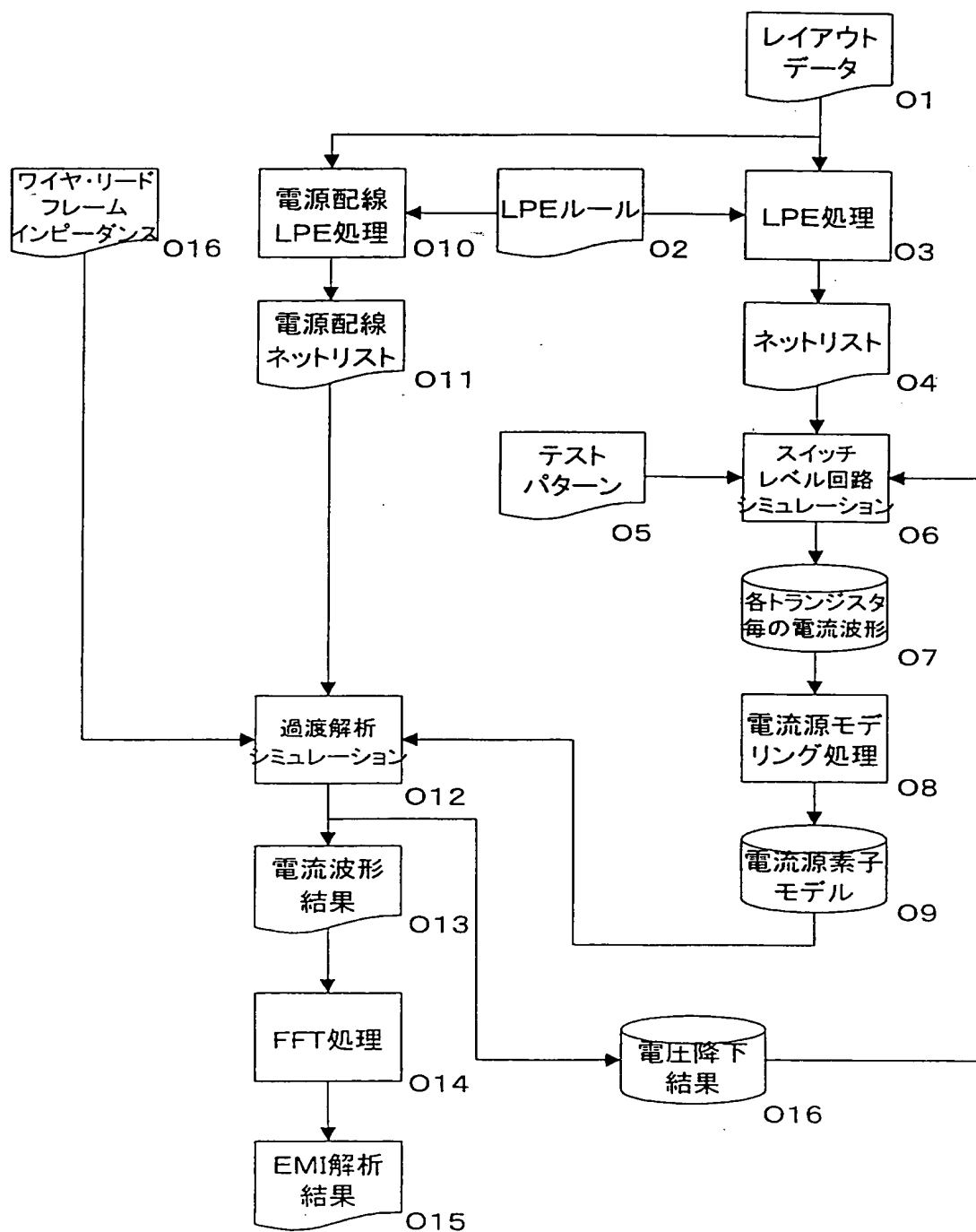
0070700 28521960 09612582 070700

Fig.115



007070"23527960

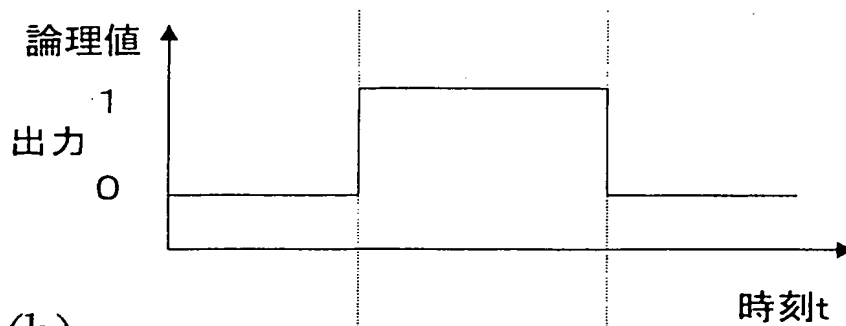
Fig.116



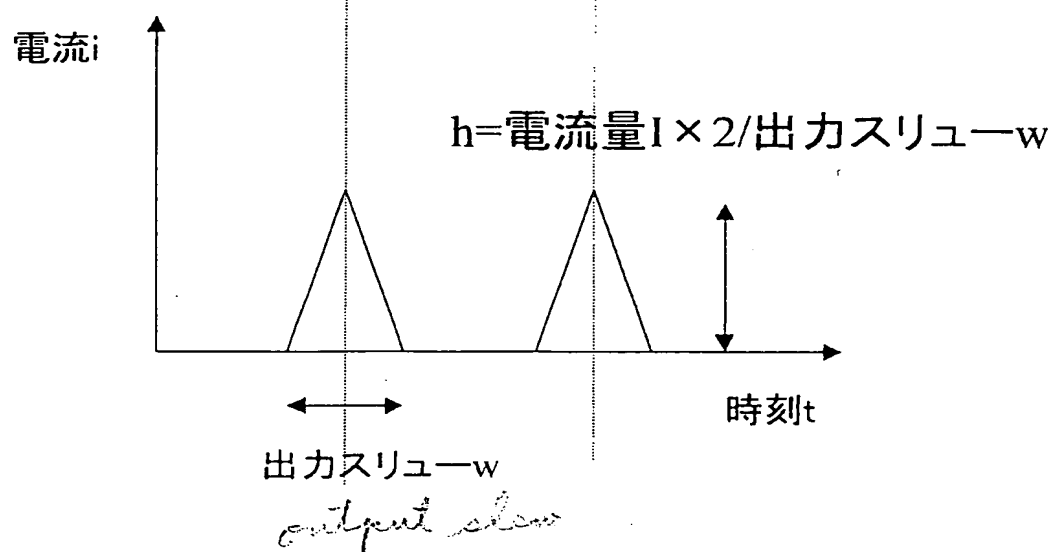
004020"2852T960

Fig.117

(a)



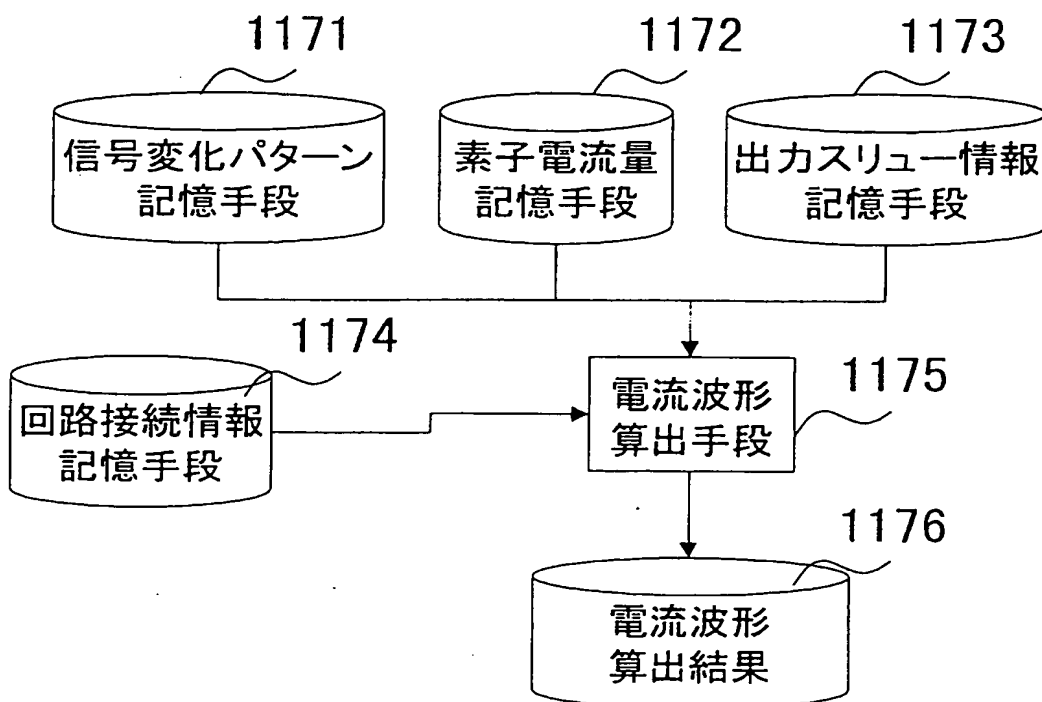
(b)



007070" 2852T960



Fig. 118



004070" 2852T960

Fig. 119

電流波形算出手段処理フロー図

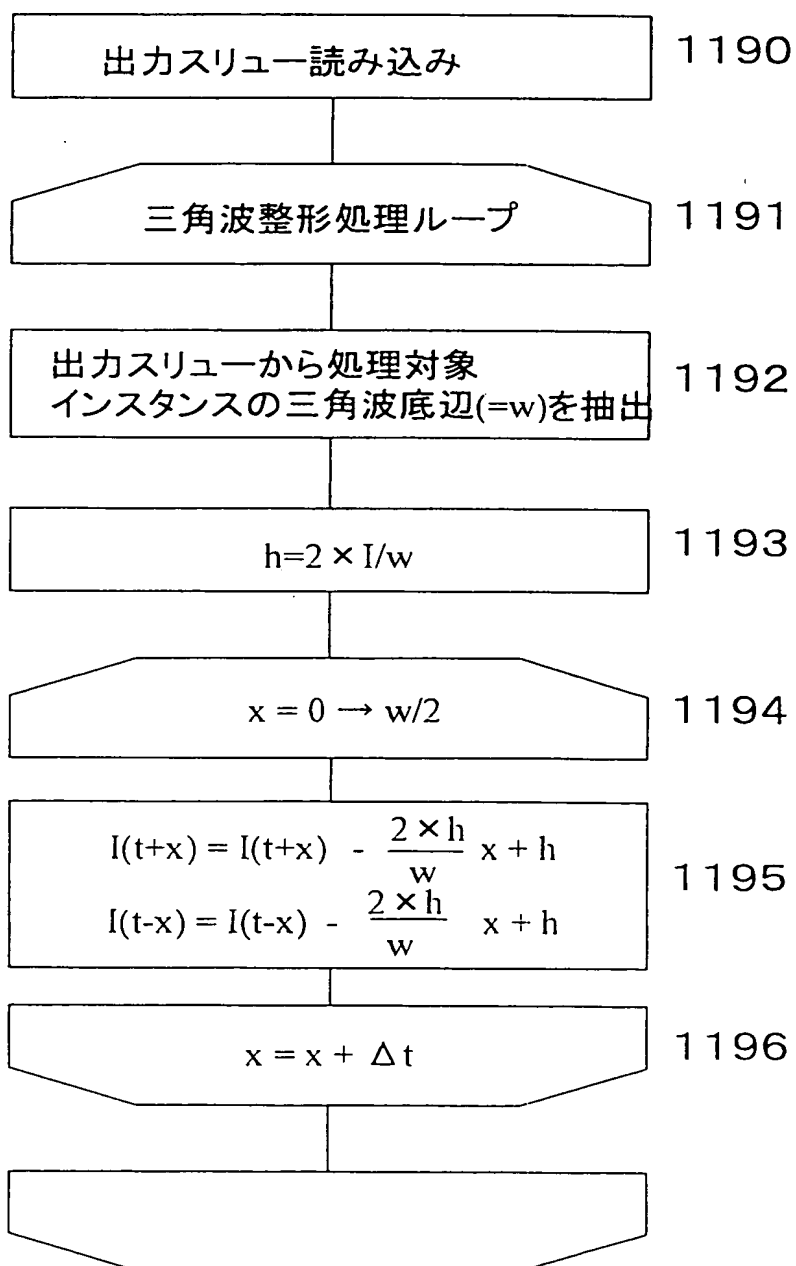
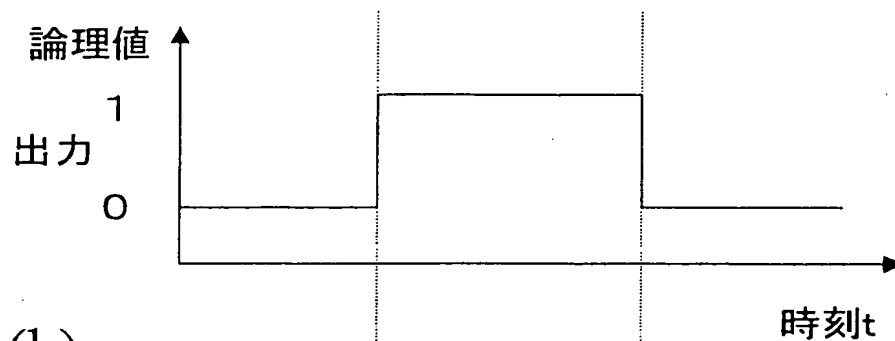
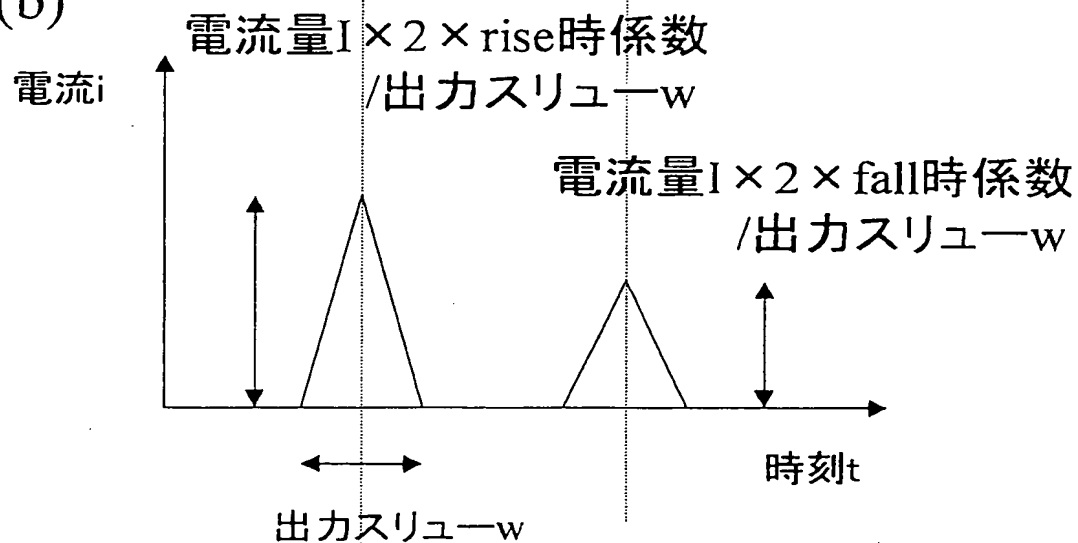
[illegible]

Fig.120

(a)



(b)



※fall時係数=2-rise時係数

004040" 2852T960

Fig.121

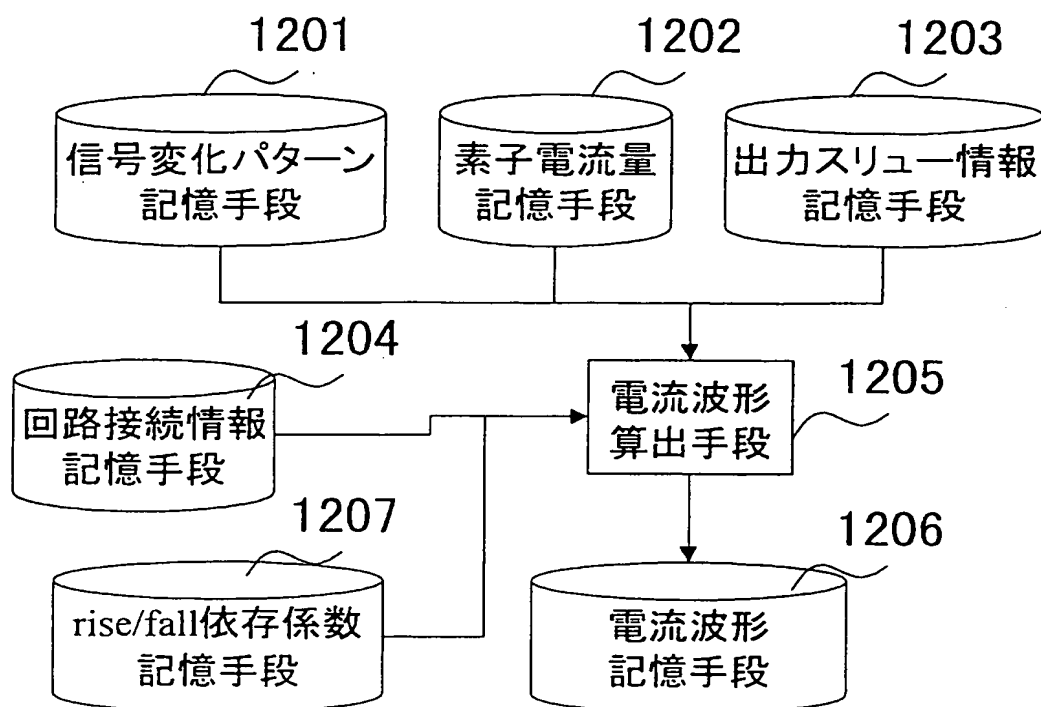
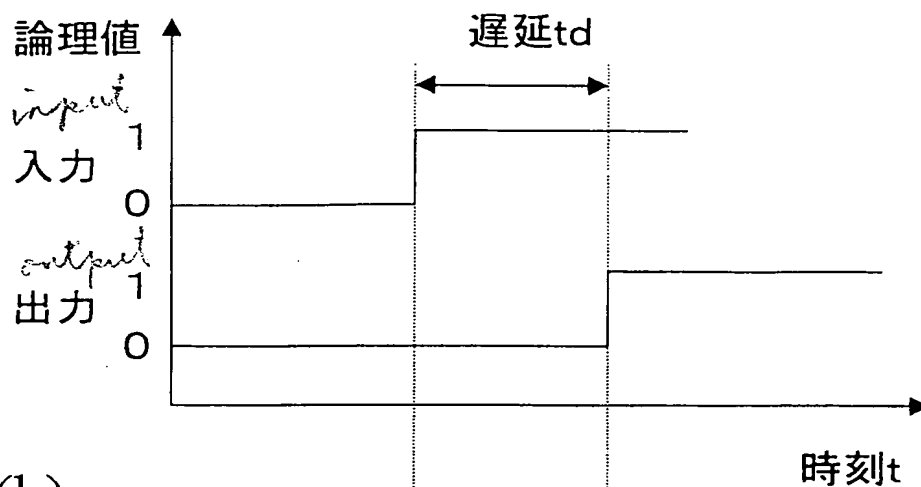
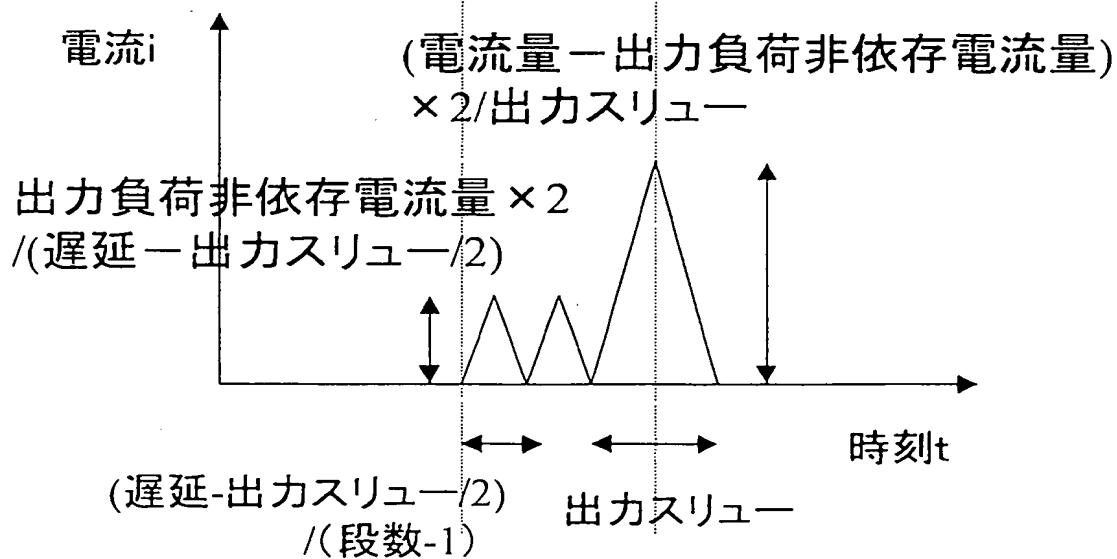


Fig. 122

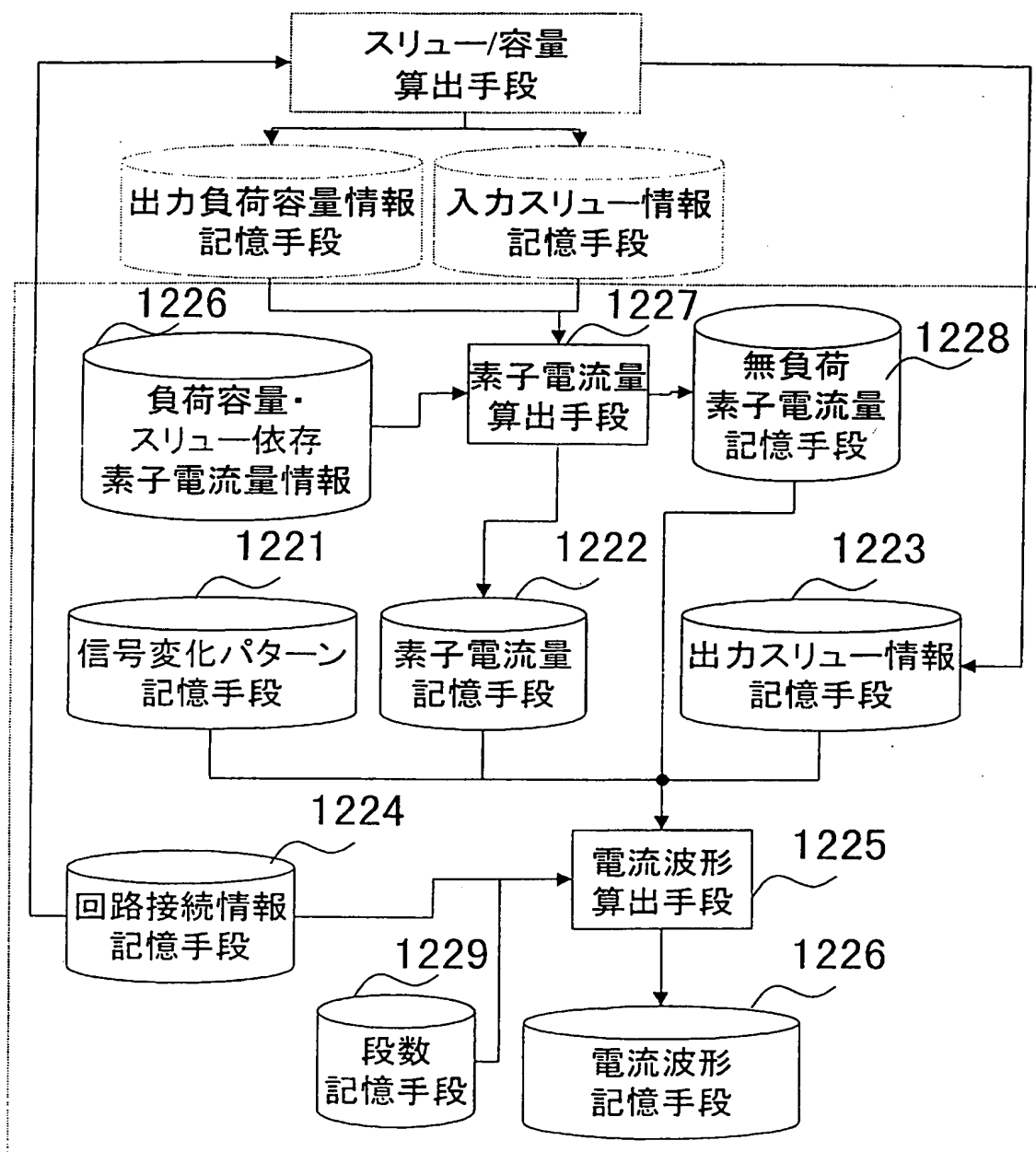
(a)



(b)



0967268-9



[Description of Reference Numerals]

- 1 net list
- 2 test vector
- 3 library
- 4 logic simulator
- 5 event information
- 6 simulation result
- 7 current waveform calculation section
- 8 current waveform calculation result
- 9 FFT processing section
- 10 result of EMI analysis
- 11 instantaneously-changing current calculation section
- 12 calculation result of instantaneously-changing  
current
- 13 current waveform averaging section
- 20 first rectangular waveform height calculation section
- 21 first rectangular waveform-shaping section
- 30 second rectangular waveform height calculation  
section
- 31 second rectangular waveform width calculation section
- 32 second rectangular waveform-shaping section
- 40 i-h table
- 41 third rectangular waveform height calculation section
- 42 third rectangular waveform width calculation section
- 43 third rectangular waveform-shaping section
- 50 i-s-h table
- 51 Slew data
- 52 fourth rectangular waveform height calculation  
section
- 53 fourth rectangular waveform width calculation section
- 54 fourth rectangular waveform-shaping section
- 60 i-c-h table
- 61 capacitance data
- 62 fifth rectangular waveform height calculation section
- 63 fifth rectangular waveform width calculation section
- 64 fifth rectangular waveform-shaping section

100 triangular waveform height calculation section  
 101 triangular waveform-shaping section  
 120 Gaussian function waveform height calculation  
 section  
 121 i-w table  
 122 Gaussian function waveform width calculation section  
 123 Gaussian function waveform-shaping section  
 130 peak current library  
 131 sixth rectangular waveform height calculation  
 section  
 132 sixth rectangular waveform width calculation section  
 133 sixth rectangular waveform shaping section  
 140 s-h table  
 141 seventh rectangular waveform height calculation  
 section  
 142 seventh rectangular waveform width calculation  
 section  
 143 seventh rectangular waveform shaping section  
 150 c-h table  
 151 eighth rectangular waveform height calculation  
 section  
 152 eighth rectangular waveform width calculation  
 section  
 153 eighth rectangular waveform shaping section  
 160 triangular waveform height calculation section  
 161 triangular waveform width calculation section  
 162 triangular waveform shaping section  
 170 multi-order-function waveform height calculation  
 section  
 171 multi-order-function waveform width calculation  
 section  
 172 multi-order-function waveform shaping section  
 180 Gaussian function waveform height calculation  
 section  
 181 width library  
 182 Gaussian function waveform width calculation section

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 09/612582  
 07/07/00



183 Gaussian function waveform shaping section

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AT T=5

[FIG. 6]

RESULT OF FFT ANALYSIS

INTENSITY

FREQUENCY

[FIG. 7]

RECTANGULAR WAVEFORM MODEL (SECOND EMBODIMENT)

W IS CONSTANT

[FIG. 8]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(SECOND EMBODIMENT)

3 LIBRARY

5 EVENT INFORMATION

8 CALCULATION RESULT OF CURRENT WAVEFORM

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

20 FIRST RECTANGULAR WAVEFORM HEIGHT CALCULATION SECTION

21 FIRST RECTANGULAR WAVEFORM SHAPING SECTION

[FIG. 9]

FLOWCHART OF FIRST RECTANGULAR WAVEFORM SHAPING OPERATION

1020 RECTANGULAR WAVEFORM SHAPING LOOP

[FIG. 10]

CALCULATION RESULT OF CURRENT WAVEFORM (SECOND EMBODIMENT)

AT W = 5

[FIG. 11]

RECTANGULAR WAVEFORM MODEL (THIRD EMBODIMENT)

$h/w = K = \text{CONSTANT}$

[FIG. 12]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION



42 THIRD RECTANGULAR WAVEFORM WIDTH CALCULATION SECTION

43 THIRD RECTANGULAR WAVEFORM SHAPING SECTION

[FIG. 18]

### FLOWCHART OF THIRD RECTANGULAR WAVEFORM SHAPING OPERATION

1040 READ i-h TABLE

## 1041 RECTANGULAR WAVEFORM SHAPING LOOP

```
1042 EXTRACT (i1, h1) (i2, h2)
```

[FIG. 19]

### CALCULATION RESULT OF CURRENT WAVEFORM (FOURTH EMBODIMENT)

[FIG. 20]

i-s-h TABLE

IN THE CASE OF  $i=70, s=1$

[FIG. 21]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(FIFTH EMBODIMENT)

3 LIBRARY

## 5 EVENT INFORMATION

## 8 CALCULATION RESULT OF CURRENT WAVEFORM

## 11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

## 12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

50 i-s-h TABLE

51 SLEW DATA

## 52 FOURTH RECTANGULAR WAVEFORM HEIGHT CALCULATION SECTION

### 53 FOURTH RECTANGULAR WAVEFORM WIDTH CALCULATION SECTION

## 54 FOURTH RECTANGULAR WAVEFORM SHAPING SECTION

[FIG. 22]

FLOWCHART OF FOURTH RECTANGULAR WAVEFORM SHAPING OPERATION

1050 READ i-s-h TABLE

1051 READ SLEW DATA

1052 RECTANGULAR WAVEFORM SHAPING LOOP

```
1053 EXTRACT (s1, i1), (s1, i2), (s2, i1), (s2, i2)
```

[FIG. 23]

CALCULATION RESULT OF CURRENT WAVEFORM (FIFTH EMBODIMENT)  
IN THE CASE OF  $i=70$ ,  $C=10$

[FIG. 24]

i-c-h TABLE

[FIG. 25]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(SIXTH EMBODIMENT)

3 LIBRARY

## 5 EVENT INFORMATION

## 8 CALCULATION RESULT OF CURRENT WAVEFORM

## 11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

## 12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

60 i-c-h TABLE

## 61 CAPACITANCE DATA

## 62 FIFTH RECTANGULAR WAVEFORM HEIGHT CALCULATION SECTION

## 63 FIFTH RECTANGULAR WAVEFORM WIDTH CALCULATION SECTION

## 64 FIFTH RECTANGULAR WAVEFORM SHAPING SECTION

[FIG. 26]

FLOWCHART OF FIFTH RECTANGULAR WAVEFORM SHAPING OPERATION

1060 READ i-c-h TABLE

## 1061 READ CAPACITANCE DATA

## 1062 RECTANGULAR WAVEFORM SHAPING LOOP

1063 EXTRACT

[FIG. 27]

### CALCULATION RESULT OF CURRENT WAVEFORM (SIXTH EMBODIMENT)

[FIG. 28]

1 NET LIST

## 2 TEST VECTOR

### 3 LIBRARY

```

4 LOGIC SIMULATOR
5 EVENT INFORMATION
6 SIMULATION RESULT
8 CALCULATION RESULT OF CURRENT WAVEFORM
9 FFT PROCESSING SECTION
10 RESULT OF EMI ANALYSIS
11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION
12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT
13 CURRENT WAVEFORM AVERAGING SECTION
A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT
TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE
A9 LAYOUT DATA
A10 I-V TABLE OR I-V FUNCTION
A11 LINE VOLTAGE DROP CALCULATION/INSTANTANEOUSLY-CHANGING
CURRENT CORRECTION SECTION

```

[FIG. 29]

```

A9 LAYOUT DATA
A10 I-V TABLE OR I-V FUNCTION
B1 INFORMATION CONCERNING INSTANTANEOUSLY-CHANGING CURRENT
FOR EACH INSTANCE
B2 EXTRACTION OF POWER NET
B3 CALCULATION OF CURRENT FLOWING IN EACH SEGMENT
B4 INFORMATION CONCERNING EACH SEGMENT IN POWER LINE
B5 INFORMATION CONCERNING CURRENT PER EACH SEGMENT
B6 CALCULATION OF RESISTANCE OF EACH SEGMENT
B7 CALCULATION OF VOLTAGE DROP IN EACH SEGMENT
B8 INFORMATION CONCERNING RESISTANCE OF EACH SEGMENT
B9 INFORMATION CONCERNING VOLTAGE DROP IN EACH SEGMENT
B10 CALCULATION OF VOLTAGE DROP OF EACH INSTANCE
B11 INFORMATION CONCERNING VOLTAGE DROP IN EACH INSTANCE
B12 CORRECTION OF ELECTRIC CURRENT

```



[FIG. 30]

INSTANCE 1, INSTANCE 2, INSTANCE 3

[FIG. 31]

INSTANCE 1, INSTANCE 2, INSTANCE 3

[FIG. 32]

INSTANCE 1, INSTANCE 2, INSTANCE 3

[FIG. 33]

INSTANCE 1, INSTANCE 2, INSTANCE 3

[FIG. 34]

INSTANCE 1, INSTANCE 2, INSTANCE 3

[FIG. 35]

INSTANCE 1, INSTANCE 2, INSTANCE 3

VOLTAGE DROP IN INSTANCE 1

VOLTAGE DROP IN INSTANCE 2

VOLTAGE DROP IN INSTANCE 3

[FIG. 36]

1 NET LIST

2 TEST VECTOR

3 LIBRARY

4 LOGIC SIMULATOR

5 EVENT INFORMATION

6 SIMULATION RESULT

8 CALCULATION RESULT OF CURRENT WAVEFORM

9 FFT PROCESSING SECTION

10 RESULT OF EMI ANALYSIS

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

13 CURRENT WAVEFORM AVERAGING SECTION

A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE

A9 LAYOUT DATA  
A10 I-V TABLE OR I-V FUNCTION  
C1 C-V TABLE OR C-V FUNCTION  
C2 LINE VOLTAGE DROP CALCULATION/INSTANTANEOUSLY-CHANGING  
CURRENT CORRECTION SECTION

[FIG. 37]

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE  
A9 LAYOUT DATA  
A10 I-V TABLE OR I-V FUNCTION  
C1 C-V TABLE OR C-V FUNCTION  
B1 INFORMATION CONCERNING INSTANTANEOUSLY-CHANGING CURRENT  
FOR EACH INSTANCE  
B2 EXTRACTION OF POWER NET  
B3 CALCULATION OF CURRENT FLOWING IN EACH SEGMENT  
B4 INFORMATION CONCERNING EACH SEGMENT IN POWER LINE  
B5 INFORMATION CONCERNING CURRENT PER EACH SEGMENT  
B6 CALCULATION OF RESISTANCE OF EACH SEGMENT  
B8 INFORMATION CONCERNING RESISTANCE OF EACH SEGMENT  
B9 INFORMATION CONCERNING VOLTAGE DROP IN EACH SEGMENT  
B10 CALCULATION OF VOLTAGE DROP OF EACH INSTANCE  
B11 INFORMATION CONCERNING VOLTAGE DROP IN EACH INSTANCE  
B12 CORRECTION OF ELECTRIC CURRENT  
D1 CALCULATION OF CAPACITANCE PROVIDED BETWEEN SEGMENTS  
D2 INFORMATION CONCERNING CAPACITANCE PROVIDED BETWEEN  
SEGMENTS  
D3 CALCULATION OF VOLTAGE DROP IN EACH SEGMENT

[FIG. 38]

INSTANCE 1, INSTANCE 2, INSTANCE 3

[FIG. 39]

INSTANCE 1, INSTANCE 2, INSTANCE 3  
VOLTAGE DROP IN INSTANCE 1

VOLTAGE DROP IN INSTANCE 2  
VOLTAGE DROP IN INSTANCE 3

[FIG. 40]

1 NET LIST  
2 TEST VECTOR  
3 LIBRARY  
4 LOGIC SIMULATOR  
5 EVENT INFORMATION  
6 SIMULATION RESULT  
8 CALCULATION RESULT OF CURRENT WAVEFORM  
9 FFT PROCESSING SECTION  
10 RESULT OF EMI ANALYSIS  
11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION  
12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
13 CURRENT WAVEFORM AVERAGING SECTION  
A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE  
A9 LAYOUT DATA  
A10 I-V TABLE OR I-V FUNCTION  
E1 LINE VOLTAGE DROP CALCULATION/INSTANTANEOUSLY-CHANGING  
CURRENT CORRECTION SECTION

[FIG. 41]

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE  
A9 LAYOUT DATA  
A10 I-V TABLE OR I-V FUNCTION  
B1 INFORMATION CONCERNING INSTANTANEOUSLY-CHANGING CURRENT  
FOR EACH INSTANCE  
B2 EXTRACTION OF POWER NET  
B4 INFORMATION CONCERNING EACH SEGMENT IN POWER LINE  
B6 CALCULATION OF RESISTANCE OF EACH SEGMENT  
B8 INFORMATION CONCERNING RESISTANCE OF EACH SEGMENT  
B11 INFORMATION CONCERNING VOLTAGE DROP IN EACH INSTANCE

B12 CORRECTION OF ELECTRIC CURRENT  
D1 CALCULATION OF CAPACITANCE PROVIDED BETWEEN SEGMENTS  
D2 INFORMATION CONCERNING CAPACITANCE PROVIDED BETWEEN  
SEGMENTS  
F1 TRANSIENT ANALYSIS

[FIG. 42]  
TRIANGULAR WAVEFORM MODEL (TENTH EMBODIMENT)  
W IS CONSTANT

[FIG. 43]  
BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(TENTH EMBODIMENT)  
3 LIBRARY  
5 EVENT INFORMATION  
8 CALCULATION RESULT OF CURRENT WAVEFORM  
11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION  
12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
100 TRIANGULAR WAVEFORM HEIGHT CALCULATION SECTION  
101 TRIANGULAR WAVEFORM SHAPING SECTION

[FIG. 44]  
FLOWCHART OF FIFTH TRIANGULAR WAVEFORM SHAPING OPERATION  
1100 TRIANGULAR WAVEFORM SHAPING LOOP

[FIG. 45]  
CALCULATION RESULT OF CURRENT WAVEFORM (TENTH EMBODIMENT)  
AT W=5

[FIG. 46]  
MULTI-ORDER-FUNCTION MODEL (ELEVENTH EMBODIMENT)  
W IS CONSTANT  
IN THE CASE OF W=2.5, i=100  
IN THE CASE OF W=2.5, i=50

[FIG. 47]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(ELEVENTH EMBODIMENT)

3 LIBRARY

5 EVENT INFORMATION

8 CALCULATION RESULT OF CURRENT WAVEFORM

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

110 MULTI-ORDER-FUNCTION WAVEFORM HEIGHT CALCULATION SECTION

111 MULTI-ORDER-FUNCTION WAVEFORM SHAPING SECTION

[FIG. 48]

FLOWCHART OF MULTI-ORDER-FUNCTION WAVEFORM SHAPING OPERATION

1110 MULTI-ORDER-FUNCTION WAVEFORM SHAPING LOOP

[FIG. 49]

CALCULATION RESULT OF CURRENT WAVEFORM (ELEVENTH EMBODIMENT)

AT  $W=2.5$

[FIG. 50]

GAUSSIAN FUNCTION MODEL (TWELFTH AND TWENTY-FIFTH EMBODIMENTS)

[FIG. 51]

i-h TABLE

IN THE CASE OF  $i=50, 100$

[FIG. 52]

i-w TABLE

IN THE CASE OF  $i=50, 100$

[FIG. 53]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(TWELFTH EMBODIMENT)

3 LIBRARY

5 EVENT INFORMATION

8 CALCULATION RESULT OF CURRENT WAVEFORM

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
40 i-h TABLE  
121 i-w TABLE  
120 GAUSSIAN FUNCTION WAVEFORM HEIGHT CALCULATION SECTION  
122 GAUSSIAN FUNCTION WAVEFORM WIDTH CALCULATION SECTION  
123 GAUSSIAN FUNCTION WAVEFORM SHAPING SECTION

[FIG. 54]

FLOWCHART OF GAUSSIAN FUNCTION WAVEFORM SHAPING

1120 READ i-h TABLE  
1121 READ i-w TABLE  
1122 PERFORM GAUSSIAN FUNCTION WAVEFORM SHAPING LOOP  
1123 EXTRACT  
1125 EXTRACT

[FIG. 55]

CALCULATION RESULT OF CURRENT WAVEFORM (TWELFTH EMBODIMENT)

[FIG. 56]

7301 CIRCUIT CONNECTION INFORMATION STORAGE MEANS  
7302 PATTERN-OF-SIGNAL-CHANGE STORAGE MEANS  
7303 ELEMENT CURRENT STORAGE MEANS  
7304 TOTAL CURRENT STORAGE MEANS  
7605 TOTAL CURRENT CALCULATION MEANS  
7306 MEANS FOR STORING BASIC INFORMATION FOR ESTIMATING  
ELECTRIC CURRENT

[FIG. 57]

FLIP-FLIP FF

THE AMOUNT OF SHORT CIRCUIT CURRENT FLOWING WHEN Y IS CHANGED  
THE AMOUNT OF CHARGE CURRENT FLOWING WHEN Y IS CHANGED  
THE AMOUNT OF SHORT CIRCUIT CURRENT FLOWING WHEN CK IS CHANGED  
THE AMOUNT OF CHARGE CURRENT FLOWING WHEN CK IS CHANGED

BUFFER BUF

THE AMOUNT OF SHORT CIRCUIT CURRENT FLOWING WHEN Y IS CHANGED

THE AMOUNT OF CHARGE CURRENT FLOWING WHEN Y IS CHANGED

[FIG. 58]

CURRENT

TIME

[FIG. 59]

7601 DISCRETE WIDTH USED FOR AVERAGING SHORT CIRCUIT CURRENT COMPONENT

7602 DISCRETE WIDTH USED FOR AVERAGING CHARGE CURRENT COMPONENT

[FIG. 60]

START ACTIVATION OF TOTAL CURRENT CALCULATION MEANS

7701 READ CIRCUIT CONNECTION INFORMATION

7702 READ PATTERN OF SIGNAL CHANGE

7703 READ INFORMATION CONCERNING THE AMOUNT OF ELECTRIC CURRENT FLOWING IN ELEMENT

7704 READ BASIC INFORMATION FOR ESTIMATING ELECTRIC CURRENT

7705 IMPART A PATTERN OF SIGNAL CHANGE TO CIRCUIT CONNECTION INFORMATION, TO THEREBY ENABLE PROPAGATION OF A SIGNAL. IN A

CASE WHERE A CHANGE HAS ARISEN IN A SIGNAL APPEARING AT AN EXTERNAL INPUT TERMINAL OF A CIRCUIT ELEMENT, THE ELEMENT BEING

DESCRIBED IN THE INFORMATION CONCERNING THE AMOUNT OF ELECTRIC CURRENT FLOWING THROUGH AN ELEMENT, ADD A SHORT CIRCUIT CURRENT

COMPONENT AND A CHARGE CURRENT COMPONENT INCLUDED IN THE

ELECTRIC CURRENT FLOWING IN THE EXTERNAL TERMINAL, AT

RESPECTIVE POINTS IN TIME, TO THE SHORT CIRCUIT CURRENT

COMPONENT AND THE CHARGE CURRENT COMPONENT INCLUDED IN THE

INFORMATION CONCERNING THE TOTAL AMOUNT OF ELECTRIC CURRENT, RESPECTIVELY.

7706 AVERAGE SHORT CIRCUIT CURRENT COMPONENT INCLUDED IN TOTAL CURRENT INFORMATION BY DISCRETE WIDTH THEREOF, AND AVERAGE

CHARGE CURRENT COMPONENT INCLUDED IN THE SAME BY DISCRETE WIDTH THEREOF, ADD AVERAGING RESULTS TOGETHER AS TOTAL AMOUNT OF

CURRENT AT RESPECTIVE TIME

7707 STORE THE TOTAL AMOUNT OF CURRENT INTO TOTAL CURRENT





140 s-h TABLE LIBRARY  
141 SEVENTH RECTANGULAR WAVEFORM HEIGHT CALCULATION SECTION  
142 SEVENTH RECTANGULAR WAVEFORM WIDTH CALCULATION SECTION  
143 SEVENTH RECTANGULAR WAVEFORM SHAPING SECTION

[FIG. 65]

FLOWCHART OF SEVENTH RECTANGULAR WAVEFORM SHAPING

1140 READ s-h TABLE  
1141 READ SLEW DATA  
1142 PERFORM RECTANGULAR WAVEFORM SHAPING LOOP  
1143 EXTRACT

[FIG. 66]

c-h TABLE  
IN THE CASE OF  $c=1.2$

[FIG. 67]

BLOCK DIAGRAM SHOWING A CURRENT WAVEFORM CALCULATION SECTION  
(SIXTEENTH EMBODIMENT)

3 LIBRARY  
5 EVENT INFORMATION  
8 CALCULATION RESULT OF CURRENT WAVEFORM  
11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION  
12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
61 CAPACITANCE DATA  
150 c-h TABLE LIBRARY  
151 EIGHTH RECTANGULAR WAVEFORM HEIGHT CALCULATION SECTION  
152 EIGHTH RECTANGULAR WAVEFORM WIDTH CALCULATION SECTION  
153 EIGHTH RECTANGULAR WAVEFORM SHAPING SECTION

[FIG. 68]

FLOWCHART OF EIGHTH RECTANGULAR WAVEFORM SHAPING

1150 READ c-h TABLE  
1151 READ CAPACITANCE DATA  
1152 PERFORM RECTANGULAR WAVEFORM SHAPING LOOP  
1143 EXTRACT

[FIG. 69]

TIME

[FIG. 70]

CURRENT

TIME

[FIG. 71]

CURRENT

TIME

[FIG. 72]

9001 CIRCUIT CONNECTION INFORMATION STORAGE MEANS

9002 PATTERN-OF-SIGNAL-CHANGE STORAGE MEANS

9003 ELEMENT CURRENT STORAGE MEANS

9004 TOTAL CURRENT STORAGE MEANS

9005 TOTAL CURRENT CALCULATION MEANS

[FIG. 74]

CURRENT

TIME

[FIG. 75]

CHANGED PINS

TIME

TOTAL CURRENT

PEAK CURRENT

[FIG. 76]

START ACTIVATION OF TOTAL CURRENT CALCULATION MEANS

9401 READ CIRCUIT CONNECTION INFORMATION

9402 READ PATTERN OF SIGNAL CHANGE

9403 READ INFORMATION CONCERNING THE AMOUNT OF ELECTRIC CURRENT  
FLOWING IN ELEMENT

9404 IMPART A PATTERN OF SIGNAL CHANGE TO CIRCUIT CONNECTION

INFORMATION, TO THEREBY ENABLE PROPAGATION OF A SIGNAL. IN A CASE WHERE A CHANGE HAS ARISEN IN A SIGNAL APPEARING AT AN EXTERNAL INPUT TERMINAL OF A CIRCUIT ELEMENT, THE ELEMENT BEING DESCRIBED IN THE INFORMATION CONCERNING THE AMOUNT OF ELECTRIC CURRENT FLOWING THROUGH AN ELEMENT, A RECTANGULAR WAVEFORM OF ELECTRIC CURRENT IS PRODUCED, BY MEANS OF AVERAGING THE AMOUNT OF ELECTRIC CURRENT FLOWING THROUGH THE EXTERNAL INPUT TERMINAL BY A PEAK VALUE. THE RECTANGULAR WAVEFORM IS ADDED TO THE INFORMATION CONCERNING THE TOTAL AMOUNT OF ELECTRIC CURRENT OBTAINED AT A TIME WHICH LAGS A PREDETERMINED PERIOD OF TIME FROM THE TIME A CHANGE HAS ARISEN IN THE EXTERNAL INPUT TERMINAL 9405 STORE, INTO TOTAL CURRENT STORAGE MEANS, TOTAL AMOUNT OF CURRENT OBTAINED AT EACH TIME

END OF OPERATION OF TOTAL CURRENT STORAGE MEANS

[FIG. 78]  
LOGIC VALUE  
TIME

[FIG. 79]  
CURRENT  
TIME

[FIG. 80]  
CURRENT  
TIME

[FIG. 81]  
EDGE  
CURRENT  
PEAK VALUE

[FIG. 82]  
CURRENT  
TIME

[FIG. 83]

START ACTIVATION OF TOTAL CURRENT CALCULATION MEANS

10101 READ CIRCUIT CONNECTION INFORMATION

10102 READ PATTERN OF SIGNAL CHANGE

10103 READ INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING IN ELEMENT

10104 IMPART A PATTERN OF SIGNAL CHANGE TO CIRCUIT CONNECTION  
INFORMATION, TO THEREBY ENABLE PROPAGATION OF A SIGNAL. IN A  
CASE WHERE A CHANGE HAS ARISEN IN A SIGNAL APPEARING AT AN  
EXTERNAL INPUT TERMINAL OF A CIRCUIT ELEMENT, THE ELEMENT BEING  
DESCRIBED IN THE INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING THROUGH AN ELEMENT, A RECTANGULAR WAVEFORM OF  
AN ELECTRIC CURRENT IS PRODUCED BY MEANS OF AVERAGING THE AMOUNT  
OF ELECTRIC CURRENT FLOWING THROUGH THE EXTERNAL INPUT TERMINAL  
AT A RISE AND FALL OF THE SIGNAL BY MEANS OF A PEAK VALUE. THE  
RECTANGULAR WAVEFORMS ARE ADDED TO THE INFORMATION CONCERNING  
THE TOTAL AMOUNT OF ELECTRIC CURRENT OBTAINED AT A TIME WHEN  
THE CHANGE HAS ARISEN IN THE SIGNAL APPEARING AT THE EXTERNAL  
INPUT TERMINAL.

10105 STORE, INTO TOTAL CURRENT STORAGE MEANS, TOTAL AMOUNT OF  
CURRENT OBTAINED AT EACH TIME

END OF OPERATION OF TOTAL CURRENT STORAGE MEANS

[FIG. 85]

TIME

[FIG. 86]

CURRENT

TIME

[FIG. 87]

CURRENT

TIME

[FIG. 88]

NOR, Y-TERMINAL

TOTAL CURRENT AT LOGIC VALUE OF 1  
PEAK CURRENT AT LOGIC VALUE OF 1  
TOTAL CURRENT AT LOGIC VALUE OF 0  
PEAK CURRENT AT LOGIC VALUE OF 0  
TOTAL CURRENT AT LOGIC VALUE OF 1  
PEAK CURRENT AT LOGIC VALUE OF 1  
TOTAL CURRENT AT LOGIC VALUE OF 0  
PEAK CURRENT AT LOGIC VALUE OF 0  
TOTAL CURRENT AT LOGIC VALUE OF 1  
PEAK CURRENT AT LOGIC VALUE OF 1  
TOTAL CURRENT AT LOGIC VALUE OF 0  
PEAK CURRENT AT LOGIC VALUE OF 0

[FIG. 89]

START ACTIVATION OF TOTAL CURRENT CALCULATION MEANS

10701 READ CIRCUIT CONNECTION INFORMATION

10702 READ PATTERN OF SIGNAL CHANGE

10703 READ INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING IN ELEMENT

10704 IMPART A PATTERN OF SIGNAL CHANGE TO CIRCUIT CONNECTION  
INFORMATION, TO THEREBY ENABLE PROPAGATION OF A SIGNAL. IN A  
CASE WHERE A CHANGE HAS ARISEN IN A SIGNAL APPEARING AT AN  
EXTERNAL INPUT TERMINAL OF A CIRCUIT ELEMENT, THE ELEMENT BEING  
DESCRIBED IN THE INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING THROUGH AN ELEMENT, A RECTANGULAR WAVEFORM OF  
AN ELECTRIC CURRENT IS PRODUCED BY MEANS OF AVERAGING THE AMOUNT  
OF ELECTRIC CURRENT FLOWING THROUGH THE EXTERNAL INPUT TERMINAL  
BY MEANS OF A PEAK VALUE IN ACCORDANCE WITH THE STATUS OF ANOTHER  
TERMINAL. THE RECTANGULAR WAVEFORM IS ADDED TO THE INFORMATION  
CONCERNING THE TOTAL AMOUNT OF ELECTRIC CURRENT OBTAINED AT A  
TIME WHEN THE CHANGE HAS ARISEN IN THE SIGNAL APPEARING AT THE  
EXTERNAL INPUT TERMINAL.

10705 STORE, INTO TOTAL CURRENT STORAGE MEANS, TOTAL AMOUNT OF  
CURRENT OBTAINED AT EACH TIME

END OF OPERATION OF TOTAL CURRENT STORAGE MEANS

[FIG. 90]

CURRENT  
TIME

TIME

[FIG. 91]

1 NET LIST

## 2 TEST VECTOR

### 3 LIBRARY

## 4 LOGIC SIMULATOR

## 5 EVENT INFORMATION

## 6 SIMULATION RESULT

## 8 CALCULATION RESULT OF CURRENT WAVEFORM

## 9 FFT PROCESSING SECTION

## 10 RESULT OF EMI ANALYSIS

## 11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

## 12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

### 13 CURRENT WAVEFORM AVERAGING SECTION

A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE

## A9 LAYOUT DATA

## G2 CHARACTERIZATION

G3 I-V TABLE OR I-V FUNCTION FOR EACH CELL

## G4 LINE VOLTAGE DROP CALCULATION/INSTANTANEOUSLY-CHANGING CURRENT CORRECTION SECTION

[FIG. 92]

## 12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

### A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE

## A9 LAYOUT DATA

B1 INFORMATION CONCERNING INSTANTANEOUSLY-CHANGING CURRENT  
FOR EACH INSTANCE

## B2 EXTRACTION OF POWER NET

### B3 CALCULATION OF ELECTRIC CURRENT FLOWING IN EACH SEGMENT

B4 INFORMATION CONCERNING EACH SEGMENT IN POWER LINE

B5 INFORMATION CONCERNING ELECTRIC CURRENT OF EACH SEGMENT

B6 CALCULATION OF RESISTANCE OF EACH SEGMENT  
 B7 CALCULATION OF VOLTAGE DROP IN EACH SEGMENT  
 B8 INFORMATION CONCERNING RESISTANCE OF EACH SEGMENT  
 B9 INFORMATION CONCERNING VOLTAGE DROP IN EACH SEGMENT  
 B10 CALCULATION OF VOLTAGE DROP IN EACH INSTANCE  
 B11 INFORMATION CONCERNING VOLTAGE DROP IN EACH INSTANCE  
 H1 CORRECTION OF ELECTRIC CURRENT  
 G3 I-V TABLE OR I-V FUNCTION FOR EACH CELL

[FIG. 93]

1 NET LIST  
 2 TEST VECTOR  
 3 LIBRARY  
 4 LOGIC SIMULATOR  
 5 EVENT INFORMATION  
 6 SIMULATION RESULT  
 8 CALCULATION RESULT OF CURRENT WAVEFORM  
 9 FFT PROCESSING SECTION  
 10 RESULT OF EMI ANALYSIS  
 11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION  
 12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
 13 CURRENT WAVEFORM AVERAGING SECTION  
 A9 LAYOUT DATA  
 I1 CHARACTERIZATION  
 I2 I-C-H TABLE OR I-C-H FUNCTION FOR EACH CELL  
 I3 LINE VOLTAGE DROP CALCULATION/INSTANTANEOUSLY-CHANGING  
 CURRENT CORRECTION SECTION

[FIG. 94]

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
 A6 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
 TAKING INTO CONSIDERATION A DROP IN LINE VOLTAGE  
 A9 LAYOUT DATA  
 B1 INFORMATION CONCERNING INSTANTANEOUSLY-CHANGING CURRENT  
 FOR EACH INSTANCE  
 B2 EXTRACTION OF POWER NET

B3 CALCULATION OF ELECTRIC CURRENT FLOWING IN EACH SEGMENT  
B4 INFORMATION CONCERNING EACH SEGMENT IN POWER LINE  
B5 INFORMATION CONCERNING ELECTRIC CURRENT OF EACH SEGMENT  
B6 CALCULATION OF RESISTANCE OF EACH SEGMENT  
B8 INFORMATION CONCERNING RESISTANCE OF EACH SEGMENT  
B9 INFORMATION CONCERNING VOLTAGE DROP IN EACH SEGMENT  
B10 CALCULATION OF VOLTAGE DROP IN EACH INSTANCE  
B11 INFORMATION CONCERNING VOLTAGE DROP IN EACH INSTANCE  
J1 CORRECTION OF ELECTRIC CURRENT  
I2 I-C-V TABLE OR I-C-V FUNCTION FOR EACH CELL  
D1 CALCULATION OF CAPACITANCE PROVIDED BETWEEN SEGMENTS  
D2 INFORMATION CONCERNING A CAPACITANCE PROVIDED BETWEEN  
SEGMENTS

[FIG. 95]

1 NET LIST  
2 TEST VECTOR  
3 LIBRARY  
4 LOGIC SIMULATOR  
5 EVENT INFORMATION  
6 SIMULATION RESULT  
8 CALCULATION RESULT OF CURRENT WAVEFORM  
9 FFT PROCESSING SECTION  
10 RESULT OF EMI ANALYSIS  
11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION  
12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT  
13 CURRENT WAVEFORM AVERAGING SECTION  
A9 LAYOUT DATA  
A10 I-V TABLE OR I-V FUNCTION FOR EACH CELL  
A11 LINE VOLTAGE DROP CALCULATION/INSTANTANEOUSLY-CHANGING  
CURRENT CORRECTION SECTION  
K1 COMPARISON/DETERMINATION

[FIG. 96]

TRIANGULAR WAVEFORM MODEL (TWENTY-THIRD EMBODIMENT)



[FIG. 97]

BLOCK DIAGRAM SHOWING CALCULATION OF A CURRENT WAVEFORM  
(TWENTY-THIRD EMBODIMENT)

3 LIBRARY

5 EVENT INFORMATION

8 CALCULATION RESULT OF CURRENT WAVEFORM

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

130 PEAK CURRENT LIBRARY

160 TRIANGULAR WAVEFORM HEIGHT CALCULATION SECTION

161 TRIANGULAR WAVEFORM WIDTH CALCULATION SECTION

162 TRIANGULAR WAVEFORM SHAPING SECTION

[FIG. 98]

FLOWCHART OF TRIANGULAR WAVEFORM SHAPING

1150 READ PEAK CURRENT LIBRARY

1161 PERFORM TRIANGULAR WAVEFORM SHAPING LOOP

1162 EXTRACT HEIGHT OF TRIANGULAR WAVEFORM OF OBJECT INSTANCE  
FROM PEAK CURRENT LIBRARY

[FIG. 99]

MULTI-ORDER-FUNCTION MODEL (TWENTY-FOURTH EMBODIMENT)

[FIG. 100]

BLOCK DIAGRAM SHOWING CALCULATION OF A CURRENT WAVEFORM  
(TWENTY-FOURTH EMBODIMENT)

3 LIBRARY

5 EVENT INFORMATION

8 CALCULATION RESULT OF CURRENT WAVEFORM

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

130 PEAK CURRENT LIBRARY

170 MULTI-ORDER-FUNCTION WAVEFORM HEIGHT CALCULATION SECTION

171 MULTI-ORDER-FUNCTION WAVEFORM WIDTH CALCULATION SECTION

172 MULTI-ORDER-FUNCTION WAVEFORM SHAPING SECTION

[FIG. 101]

FLOWCHART OF MULTI-ORDER-FUNCTION WAVEFORM SHAPING

1170 READ PEAK CURRENT LIBRARY

1171 PERFORM MULTI-ORDER-FUNCTION WAVEFORM SHAPING LOOP

1172 EXTRACT HEIGHT OF TRIANGULAR WAVEFORM OF OBJECT INSTANCE  
FROM PEAK CURRENT LIBRARY

[FIG. 102]

BLOCK DIAGRAM SHOWING CALCULATION OF A CURRENT WAVEFORM  
(TWENTY-FIFTH EMBODIMENT)

3 LIBRARY

5 EVENT INFORMATION

8 CALCULATION RESULT OF CURRENT WAVEFORM

11 INSTANTANEOUSLY-CHANGING CURRENT CALCULATION SECTION

12 CALCULATION RESULT OF INSTANTANEOUSLY-CHANGING CURRENT

130 PEAK CURRENT LIBRARY

181 WIDTH LIBRARY

180 GAUSSIAN FUNCTION WAVEFORM HEIGHT CALCULATION SECTION

182 GAUSSIAN FUNCTION WAVEFORM WIDTH CALCULATION SECTION

183 GAUSSIAN FUNCTION WAVEFORM SHAPING SECTION

[FIG. 103]

FLOWCHART OF GAUSSIAN FUNCTION WAVEFORM SHAPING

1180 READ PEAK CURRENT LIBRARY

1181 READ WIDTH LIBRARY

1182 PERFORM GAUSSIAN FUNCTION WAVEFORM SHAPING LOOP

1183 EXTRACT HEIGHT OF TRIANGULAR WAVEFORM OF OBJECT INSTANCE  
FROM PEAK CURRENT LIBRARY

1184 EXTRACT WIDTH OF OBJECT INSTANCE FROM WIDTH LIBRARY

[FIG. 104]

CURRENT

TIME

[FIG. 105]

FLIP-FLOP FF/Q

TOTAL SHORT CIRCUIT CURRENT  
PEAK VALUE OF SHORT CIRCUIT CURRENT  
TOTAL CHARGE CURRENT  
PEAK VALUE OF CHARGE CURRENT

FLIP-FLOP FF/CK  
TOTAL SHORT CIRCUIT CURRENT  
PEAK VALUE OF SHORT CIRCUIT CURRENT  
TOTAL CHARGE CURRENT  
PEAK VALUE OF CHARGE CURRENT

BUFFER BUF/Y  
TOTAL SHORT CIRCUIT CURRENT  
PEAK VALUE OF SHORT CIRCUIT CURRENT  
TOTAL CHARGE CURRENT  
PEAK VALUE OF CHARGE CURRENT

[FIG. 106]  
CURRENT  
TIME

[FIG. 107]  
START ACTIVATION OF TOTAL CURRENT CALCULATION MEANS  
12501 READ CIRCUIT CONNECTION INFORMATION  
12502 READ PATTERN OF SIGNAL CHANGE  
12503 READ INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING IN ELEMENT  
12504 IMPART A PATTERN OF SIGNAL CHANGE TO CIRCUIT CONNECTION  
INFORMATION, TO THEREBY ENABLE PROPAGATION OF A SIGNAL. IN A  
CASE WHERE A CHANGE HAS ARISEN IN A SIGNAL APPEARING AT AN  
EXTERNAL INPUT TERMINAL OF A CIRCUIT ELEMENT, THE ELEMENT BEING  
DESCRIBED IN THE INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING THROUGH AN ELEMENT, A RECTANGULAR WAVEFORM OF  
AN ELECTRIC CURRENT IS PRODUCED BY MEANS OF AVERAGING SHORT  
CIRCUIT CURRENT OF THE ELECTRIC CURRENT BY MEANS OF A PEAK VALUE  
THEREOF. A RECTANGULAR WAVEFORM OF AN ELECTRIC CURRENT IS

PRODUCED BY MEANS OF AVERAGING CHARGE CURRENT OF THE ELECTRIC  
CURRENT BY MEANS OF A PEAK CURRENT THEREOF. THE RECTANGULAR  
WAVEFORMS ARE ADDED TO THE INFORMATION CONCERNING THE TOTAL  
AMOUNT OF ELECTRIC CURRENT OBTAINED AT A TIME WHEN THE CHANGE  
HAS ARISEN IN THE SIGNAL APPEARING AT THE EXTERNAL INPUT  
TERMINAL.

12505 STORE, INTO TOTAL CURRENT STORAGE MEANS, TOTAL AMOUNT OF  
CURRENT OBTAINED AT EACH TIME  
END OF OPERATION OF TOTAL CURRENT STORAGE MEANS

[FIG. 109]

1001 CIRCUIT CONNECTION INFORMATION STORAGE MEANS  
1002 PATTERN-OF-SIGNAL-CHANGE STORAGE MEANS  
1003 ELEMENT CURRENT STORAGE MEANS  
1004 TOTAL CURRENT STORAGE MEANS  
1005 TOTAL CURRENT CALCULATION MEANS

[FIG. 111]

TIME

[FIG. 112]

FLIP-FLOP FF

THE AMOUNT OF CURRENT FLOWING WHEN Y IS CHANGED  
THE AMOUNT OF CURRENT FLOWING WHEN CK IS CHANGED

BUFFER BUF

THE AMOUNT OF CURRENT FLOWING WHEN Y IS CHANGED

[FIG. 113]

TOTAL CURRENT  
TIME

[FIG. 114]

START ACTIVATION OF TOTAL CURRENT CALCULATION MEANS  
1501 READ CIRCUIT CONNECTION INFORMATION  
1502 READ PATTERN OF SIGNAL CHANGE

1503 READ INFORMATION CONCERNING THE AMOUNT OF ELECTRIC CURRENT  
FLOWING IN ELEMENT

1504 IMPART A PATTERN OF SIGNAL CHANGE TO CIRCUIT CONNECTION  
INFORMATION, TO THEREBY ENABLE PROPAGATION OF A SIGNAL. IN A  
CASE WHERE A CHANGE HAS ARISEN IN A SIGNAL APPEARING AT AN  
EXTERNAL INPUT TERMINAL OF A CIRCUIT ELEMENT, THE ELEMENT BEING  
DESCRIBED IN THE INFORMATION CONCERNING THE AMOUNT OF ELECTRIC  
CURRENT FLOWING THROUGH AN ELEMENT, THE AMOUNT OF CURRENT  
APPEARING AT THE CIRCUIT ELEMENT IS ADDED TO THE INFORMATION  
CONCERNING THE TOTAL AMOUNT OF ELECTRIC CURRENT OBTAINED AT EACH  
TIME.

1505 STORE, INTO TOTAL CURRENT STORAGE MEANS, TOTAL AMOUNT OF  
CURRENT OBTAINED AT EACH TIME  
END OF OPERATION OF TOTAL CURRENT STORAGE MEANS

[FIG. 115]  
TIME

[FIG. 116]

01 LAYOUT DATA  
02 LPE RULE  
03 LPE PROCESSING  
04 NET LIST  
05 TEST PATTERN  
06 SWITCH-SCALE CIRCUIT SIMULATION  
07 CURRENT WAVEFORM OF EACH TRANSISTOR  
08 MODELING OF CURRENT SOURCE  
09 MODELING OF CURRENT SOURCE ELEMENT  
010 LPE PROCESSING OF POWER LINE  
011 POWER LINE NET LIST  
012 TRANSIENT ANALYSIS SIMULATION  
013 RESULT OF CURRENT WAVEFORM  
014 FFT PROCESSING  
015 RESULT OF EMI ANALYSIS  
016 WIRE-LEAD FRAME IMPEDANCE

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[FIG. 117A]  
LOGIC VALUE  
TIME

[FIG. 117B]  
CURRENT  
 $h = \text{CURRENT (I)} \times 2 / \text{OUTPUT SLEW (W)}$   
OUTPUT SLEW (W)  
TIME

[FIG. 118]  
1171 PATTERN-OF-SIGNAL-CHANGE STORAGE MEANS  
1172 ELEMENT CURRENT STORAGE MEANS  
1173 OUTPUT SLEW INFORMATION STORAGE MEANS  
1174 CIRCUIT CONNECTION INFORMATION STORAGE MEANS  
1175 CURRENT WAVEFORM CALCULATION MEANS  
1176 CALCULATION RESULT OF CURRENT WAVEFORM

[FIG. 119]  
FLOWCHART OF CALCULATION OF CURRENT WAVEFORM  
1190 READ OUTPUT SLEW  
1191 PERFORM TRIANGULAR WAVEFORM SHAPING LOOP  
1192 EXTRACT BASE OF TRIANGULAR WAVE FROM OBJECT INSTANCE FROM  
OUTPUT SLEW

[FIG. 120A]  
LOGIC VALUE  
OUTPUT  
TIME

[FIG. 120B]  
CURRENT  
TIME  
OUTPUT SLEW  
 $\text{CURRENT (I)} \times 2 \times \text{RISE-DEPENDENT COEFFICIENT} / \text{OUTPUT SLEW (W)}$   
 $\text{CURRENT (I)} \times 2 \times \text{FALL-DEPENDENT COEFFICIENT} / \text{OUTPUT SLEW (W)}$

FALL-DEPENDENT COEFFICIENT = 2 - RISE-DEPENDENT COEFFICIENT

[FIG. 121]

1201 PATTERN-OF-SIGNAL-CHANGE STORAGE MEANS  
1202 ELEMENT CURRENT STORAGE MEANS  
1203 OUTPUT SLEW INFORMATION STORAGE MEANS  
1204 CIRCUIT CONNECTION INFORMATION STORAGE MEANS  
1205 CURRENT WAVEFORM CALCULATION MEANS  
1206 CURRENT WAVEFORM STORAGE MEANS  
1207 RISE-DEPENDENT COEFFICIENT/FALL-DEPENDENT COEFFICIENT  
STORAGE MEANS

[FIG. 122A]

LOGIC VALUE, DELAY  
INPUT  
OUTPUT  
TIME

[FIG. 122B]

CURRENT  
TIME  
 $(\text{CURRENT} - \text{CURRENT WHICH IS NOT DEPENDENT ON OUTPUT LOAD}) \times 2 / \text{OUTPUT SLEW}$   
 $\text{CURRENT WHICH IS NOT DEPENDENT ON OUTPUT LOAD} \times 2 / (\text{DELAY} - \text{OUTPUT SLEW} / 2)$   
 $(\text{DELAY} - \text{OUTPUT SLEW} / 2) / (\text{NUMBER OF STAGES} - 1)$   
OUTPUT SLEW  
TIME

[FIG. 123]

SLEW/CAPACITANCE CALCULATION MEANS  
OUTPUT LOAD CAPACITANCE INFORMATION STORAGE MEANS  
INPUT SLEW INFORMATION STORAGE MEANS  
1221 PATTERN-OF-SIGNAL-CHANGE STORAGE MEANS  
1222 ELEMENT CURRENT STORAGE MEANS  
1223 OUTPUT SLEW INFORMATION STORAGE MEANS

1224 CIRCUIT CONNECTION INFORMATION STORAGE MEANS  
1225 CURRENT WAVEFORM CALCULATION MEANS  
1226 CURRENT WAVEFORM STORAGE MEANS  
1227 ELEMENT CURRENT CALCULATION MEANS  
1228 NON-LOAD ELEMENT CURRENT STORAGE MEANS  
1229 NUMBER-OF-STAGES STORAGE MEANS

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